**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
GREAT LAKES NATIONAL PROGRAM OFFICE
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

Stephen Galarneau, Director
Office of Great Waters – Great Lakes & Mississippi River
Wisconsin Department of Natural Resources
PO Box 7921
Madison, WI 53707-7921

Dear Mr. Galarneau:

Thank you for your April 8, 2022 request to remove the *Degradation of Aesthetics* Beneficial Use Impairment (BUI) from the Lower Green Bay and Fox River Area of Concern (AOC) located in Green Bay, WI. As you know, we share your desire to restore all the Great Lakes AOCs and to formally delist them.

Based upon a review of your submittal and supporting information, the U.S. Environmental Protection Agency (EPA) approves your request to remove this BUI from the Lower Green Bay and Fox River AOC. EPA will notify the International Joint Commission (IJC) of this significant positive environmental change at this AOC.

We congratulate you and your staff as well as the many federal, state and local partners who have been instrumental in achieving this environmental improvement. Removal of this BUI will benefit not only the people who live and work in the AOC, but all residents of Wisconsin and the Great Lakes basin as well.

We look forward to the continuation of this important and productive relationship with your agency as we work together to delist this AOC in the years to come. If you have any further questions, please contact me at (312) 353-8320 or your staff can contact Leah Medley at (312) 886-1307.

Sincerely,

CHRISTOPHE
R KORLESKI

Digitally signed by
CHRISTOPHER KORLESKI
Date: 2022.04.15 12:25:04
-05'00'

Chris Korleski, Director
Great Lakes National Program Office

cc: Brie Kupsky, WDNR
Kendra Axness, WDNR
Rebecca Fedak, WDNR
Raj Bejankiwar, IJC

**State of Wisconsin**
**DEPARTMENT OF NATURAL RESOURCES**

**Tony Evers, Governor**
**Preston D. Cole, Secretary**
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

WISCONSIN
DEPT. OF NATURAL RESOURCES

April 8, 2022

Chris Korleski, Director
Great Lakes National Program Office
U.S. Environmental Protection Agency
77 West Jackson Boulevard (G-17J)
Chicago IL 60604-3507

Subject: Removal of the Degradation of Aesthetics Beneficial Use Impairment in the Lower Green Bay and Fox River Area of Concern

Dear Mr. Korleski:

The Wisconsin Department of Natural Resources (WDNR) requests the U.S. Environmental Protection Agency (U.S. EPA) Great Lakes National Program Office's (GLNPO's) concurrence with the removal of the Degradation of Aesthetics Beneficial Use Impairment (BUI) in the Lower Green Bay and Fox River Area of Concern (AOC).

Wisconsin DNR has assessed the status of the Degradation of Aesthetics BUI relative to the BUI removal target through six years of data collection and the results indicate that the BUI removal criteria have been met. The enclosed Degradation of Aesthetics Beneficial Use Impairment Removal Recommendation document provides the information to support the removal recommendation. We held a public comment period for the removal recommendation document from May 3 through June 4, 2021. We received six comments opposing the removal which we have addressed in Appendix G. To help address comments, Office of Great Waters collaborated with Wisconsin DNR Bureau of Environmental Analysis and Sustainability social scientists to further analyze the aesthetics BUI assessment data. The findings of the additional analysis are described in the BUI removal document and are incorporated into the responses to comments. The findings support removal.

The aesthetics of the Lower Green Bay and Fox River AOC have benefitted from the efforts of many other programs and partners over the last several decades: the implementation of regulatory programs aimed at improving water quality; federal, state, and local habitat restoration efforts along the shoreline and in the waters of the Fox River and Green Bay; and local initiatives to redevelop shorelines and increase public access. The BUI removal recognizes the significant progress made since the AOC was listed. However, more work is needed beyond the scale of the AOC to realize water quality goals, reduce the impact of invasive species, and improve aesthetic value. These important collective efforts will be in place long term and many partners are working to achieve goals outlined in the Lower Fox River Basin Total Maximum Daily Load (TMDL) and Lake Michigan Lakewide Action and Management Plan (LAMP).

Because of the significant progress made since the time of AOC designation, and because the BUI removal target has been met, we are recommending the removal of the Degradation of Aesthetics BUI from the list of impairments in the Lower Green Bay and Fox River AOC.

We value our continuing partnership in the AOC program and look forward to working closely with U.S. EPA GLNPO and stakeholders in the removal of BUIs and the delisting of Wisconsin's AOCs. If you need additional information, please contact Brie Kupsky, WDNR, at 920-838-5312, Rebecca Fedak, WDNR, 920-207-8380, or you may contact me.

Sincerely,

Stephen G. Galarneau, Director
Office of Great Waters – Great Lakes and Mississippi River
Wisconsin Department of Natural Resources
608-266-1956
Stephen.Galarneau@Wisconsin.gov

# Lower Green Bay & Fox River Area of Concern
# Beneficial Use Impairment Removal Recommendation:
# Degradation of Aesthetics

Submitted to:
USEPA-Great Lakes National Program Office
77 W. Jackson Blvd.
Chicago, IL 60604

By:
Wisconsin Department of Natural Resources
Office of Great Waters

April 2022

WISCONSIN
DEPT. OF NATURAL RESOURCES

# Acknowledgments

Prepared by:

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Wisconsin Department of Natural Resources - Office of Great Waters
2984 Shawano Avenue,
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The Wisconsin Department of Natural Resources would like to acknowledge the support and input provided by the Lower Green Bay & Fox River Area of Concern stakeholders in the development of the Degradation of Aesthetics Beneficial Use Impairment Removal Recommendation. Local input and associated efforts are an invaluable part of the process to remove remaining Beneficial Use Impairments and reflects the incredible ongoing efforts that will enable us to continue forging the path to delisting.

Photo Credit: City of Green Bay

# Disclaimer

The Great Lakes Water Quality Agreement (GLWQA) is a non-regulatory agreement between the United States and Canada, and criteria developed under its auspices are non-regulatory. The actions identified in this document were needed to meet beneficial use impairment removal targets leading to the delisting of the AOC.

# Nondiscrimination and Accessibility Statement

The Wisconsin Department of Natural Resources (DNR) is committed to promoting diversity, fairness, equity and the principles of environmental justice. We ensure that we do not discriminate in employment, programs, decisions, actions or delivery of services. If you have questions or to request information in an alternative format (large print, Braille, audio tape, etc.), please contact us at 888-936-7463 or at https://dnr.wisconsin.gov/About/Nondiscrimination

# Executive Summary

The Lower Green Bay and Fox River was designated as an Area of Concern (AOC) under the GLWQA in 1987. The designation was due to the existence of severely contaminated sediments and water quality issues that originated from municipal and industrial effluents, as well as nutrients from the watershed, creating an aquatic environment toxic to human, fish, and wildlife health.

In the 1993 Remedial Action Plan (RAP), eleven confirmed and two suspected beneficial use impairments (BUIs) were identified in the Lower Green Bay & Fox River AOC. The Degradation of Aesthetics BUI was listed as confirmed due to total suspended solids and subsequent algal blooms causing frequent unnatural color and turbidity limiting recreational use and degrading aesthetic value of AOC waterbodies. Additional factors included odor problems attributed to the decomposition of algal material and emissions from power generating facilities, industries, and wastewater treatment plants, zebra mussel shell piles along the shoreline, and limited shoreline access and public space along the Fox River.

To date, several regulations, policies, and efforts have been implemented to reduce point source pollution from industrial and urban sources. The passage of the Clean Water Act in 1972 and subsequent amendments allowed the State of Wisconsin to regulate pollutant discharge to all waters of the state, including oxygen-consuming compounds, Polychlorinated Biphenyls (PCBs), and other toxic chemicals plaguing the Fox River and bay of Green Bay. A US Environmental Protection Agency (USEPA) approved Total Maximum Daily Load (TMDL) was established for the Lower Fox River basin in 2012 that outlined sources of total phosphorus and sediment pollution and necessary reductions to meet water quality standards at the mouth of the Fox River and bay of Green Bay. To date, 9 Key Element Plans that further define contributing causes and sources of nonpoint source pollution and prioritize restoration and protection strategies to address water quality problems have been developed for several subwatersheds in the basin. Additionally, several other local efforts to improve the waterfront have been in place for decades, including remediation of contaminated sediment, shoreline redevelopment, increases in public greenspace and recreational opportunities, and restoration of fish and wildlife habitat.

A BUI removal target, established in 2009 and revised in 2021, requires at least five years of monitoring data to demonstrate that AOC waterbodies do not exhibit unacceptable levels of properties that can impair access, enjoyment, or use with public rights. To evaluate if the BUI removal criteria were met, a Volunteer Aesthetics Monitoring Program was established in 2011 and continued into 2018. This program provided volunteers with survey forms to evaluate several different public recreation areas across the AOC. Results from 6 years of data collection are presented in this document and indicate that the BUI removal criteria have been met.

While significant improvements have been made to the shoreline and waters of the Fox River and Green Bay since the designation of the AOC, more work is needed beyond the scale of the AOC to realize water quality goals, reduce the impact of invasive species, and improve aesthetic value. These important collective efforts will be in place long term and are working to achieve goals outlined in the Lake Michigan Lakewide Action and Management Plan (LAMP).

# Table of Contents

# List of Figures



# List of Tables

# Purpose

The purpose of this document is to provide evidence that supports the removal of the Degradation of Aesthetics Beneficial Use Impairment (BUI) within the Lower Green Bay & Fox River Area of Concern (AOC). This document provides information that supports the removal recommendation, including summaries of historical and contemporary actions, survey data, and other lines of evidence. More information on the AOC can be found on the Wisconsin DNR website at: https://dnr.wisconsin.gov/topic/GreatLakes/GreenBay.html

# Background

## Rationale for AOC Designation

In 1987, the lower Green Bay and Fox River was designated as an AOC under the GLWQA due to pollution discharges from municipal and industrial wastewater, as well as nutrient inputs from various industrial and municipal point and agricultural nonpoint sources. The sources originate and/or are transported to the AOC immediately below the De Pere Dam to the mouth of the river and extend into the head of the lower bay of Green Bay to an imaginary line drawn between Long Tail Point and Point au Sable (Figure 1). The 1993 Remedial Action Plan Update (WDNR, 1993) identified thirteen BUIs in the AOC, eleven of which were confirmed and two designated as suspected impairments. The following list shows the status of the thirteen BUIs originally identified in the 1993 RAP:

*Confirmed*

- Restrictions on Fish and Wildlife Consumption
- Degradation of Fish and Wildlife Populations
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Benthos
- Eutrophication or Undesirable Algae
- Restrictions on Drinking Water, or Taste and Odor Problems
- Beach Closings
- Degradation of Aesthetics
- Degradation of Phytoplankton and Zooplankton Populations
- Loss of Fish and Wildlife Habitat

*Suspected*

- Fish Tumors or Other Deformities

*Removed*

- Tainting of Fish and Wildlife Flavor (April 2020)
- Restrictions on Dredging Activities (September 2021)

## AOC Boundary

The AOC includes the last 7 miles of the Fox River from the De Pere Dam to the mouth and extends into lower Green Bay up to an imaginary line crossing the bay from Long Tail Point to Point au Sable (Figure 1).


*Figure 1. A map of the Lower Green Bay & Fox River Area of Concern boundary.*

## Rationale for BUI Listing and BUI Removal Criteria

Much of the point source pollution that was generated within the AOC stemmed from what was said to be one of the highest concentrations of paper mills in the world, located along the Fox River below Lake Winnebago. Prior to the establishment of flagship environmental policies and regulations, untreated industrial and municipal effluent was discharged to the Fox River, carrying nutrients and environmental contaminants that increased oxygen consumption by bacteria and caused significant sediment contamination in the river and lower bay of Green Bay (Sullivan & Delfino, 1982). Additionally, point and nonpoint source runoff from the Lower Fox River basin carrying phosphorus and sediment further degraded water quality, causing frequent fish kills, algae blooms, and odors in AOC waterbodies (Figure 2).

AND IT'S NOT ALONE

8/19/59

# Waste in River Gives Green Bay Odor All Its Own

## *Yet Wisconsin Senators Hit Chicago's Fight on Pollution*

BY NICHOLAS SHUMAN

*Staff Writer*

GREEN BAY, Wis. — Citizens of this Northlands city are literally choking on their own industrial wastes.

*Figure 2. Newspaper article published in the Chicago Daily News August 19, 1959 regarding odors emanating from the East and Fox Rivers.*

The effects of industrialization, urbanization, and land use changes on aesthetic value of AOC waterbodies were documented in the 1988 Remedial Action Plan, with 7 of the total 16 Key Actions identified in need of implementation to improve aesthetic quality of the Fox River and lower bay of Green Bay:

- Key Action 1: Reduce phosphorus inputs to the river and bay from nonpoint and point sources
- Key Action 2: Reduce sediment and suspended solids inputs
- Key Action 5: Continue control of oxygen-demanding wastes (BOD) from municipal and industrial point source discharges
- Key Action 6: Protect wetlands and manage habitat and wildlife
- Key Action 7: Reduce/control populations of problem fish
- Key Action 9: Reduce sediment resuspension
- Key Action 14: Enhance public and private shoreline uses

The 1993 RAP Update confirmed Degradation of Aesthetics as a beneficial use impairment (BUI) per the following 1991 IJC listing guidelines:

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

Total suspended solids and subsequent algal blooms causing frequent unnatural color and turbidity were listed as the prime reasons for limited recreational use and degraded aesthetic value. Additional factors included: odor problems attributed to the decomposition of algal material and emissions from power generating facilities, industries, and wastewater treatment plants, zebra mussel shell piles along the shoreline, and limited shoreline access and public space along the Fox River.

In 2009 WDNR worked with stakeholders and community members to develop delisting targets for all confirmed and one suspected BUIs. Because the 1993 RAP confirmed the Degradation of Aesthetics BUI primarily on the basis of persistent total suspended solids and algal blooms, the following 2009 removal target was established:

*The Degradation of Aesthetics impairment may be delisted when:*

- *Total phosphorus and total suspended solid concentrations at the mouth of the Lower Fox River meet water quality standards and/or water quality targets specified in a State and USEPA approved TMDL; and*
- *Monitoring data within the AOC and/or surveys for any five-year period indicates that water bodies in the AOC do not exhibit unacceptable levels of the following properties in quantities which interfere with the Water Quality Standards for Surface Waters:*
    a) *Substances that will cause objectionable deposits on the shore or in the bed of a body of water shall not be present in such amounts as to interfere public rights in waters of the state or impair use.*
    b) *Floating or submerged debris, oil, scum, or other material shall not be present in such amounts as to interfere with public rights in waters of the state or impair use.*

c) *Materials producing color, odor, taste, or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state or impair use.*

To evaluate the status of the second portion of the 2009 target, a pilot Volunteer Aesthetics Monitoring program began in 2011 and was expanded through 2013. In 2014, WDNR and stakeholders worked to update and expand the Volunteer Aesthetics Monitoring program to improve consistency and establish BUI status assessment thresholds. This updated program ran from 2015 to 2019.

Additionally, the onset of the Great Lakes Restoration Initiative (GLRI) in 2010 prompted an evaluation of the AOC program scope, and DNR and USEPA determined that achieving the TMDL is beyond the intent of the AOC program since it is not intended to replace regulatory compliance programs. Therefore, in 2015 WDNR began discussing the need for a revision to the 2009 BUI removal target with AOC stakeholders. A proposed revision to the BUI removal target was drafted as a memo and publicly noticed via WDNR GovDelivery and can be found in Appendix G along with relevant comments and responses received. The formal target revision completed in early 2021 focuses solely on monitoring data evaluating parameters included in the IJC listing guidelines:

*The Degradation of Aesthetics BUI can be removed when:*

- *Monitoring data within the AOC and/or surveys for any five-year period indicates that water bodies in the AOC do not exhibit unacceptable levels of the following properties sufficient to impair access, enjoyment or use with public rights in waters of the state or impair use:*
    - *Substances that cause objectionable deposits on the shore or in the bed of a body of water;*
    - *Floating or submerged debris, oil, scum, or other material;*
    - *Materials producing color, odor, taste, or unsightliness.*

# Efforts to Improve Aesthetic Value in the AOC

*Water Quality Improvements (Figure 3)*

The passage of the Clean Water Act in 1972 and subsequent amendments allowed the State of Wisconsin to develop the Wisconsin Pollutant Discharge Elimination System (WPDES) to regulate pollutant discharge to all waters of the state, including oxygen-consuming compounds, PCBs and other toxic chemicals plaguing the Fox River and bay of Green Bay. In 1972, the Great Lakes Water Quality Agreement was signed by both the United States and Canadian governments. The agreement committed both countries to working cooperatively to protect the chemical, physical, and biological integrity of the Great Lakes System, with its first iteration focusing primarily on reduction of excessive nutrient loading from point source dischargers.

In 1979, USEPA banned PCB production, and local industries and municipalities invested millions of dollars in pollution control technology through the 1980's. From 2002 to 2008, WDNR and USEPA established Records of Decision (ROD) for segments of the Fox River and Green

Bay (“Operable Units” (OUs)) under the authority of a CERCLA order issued by USEPA, with several options for contaminated sediment cleanup that were based on the results of several demonstration projects and public input (WDNR, 2020). This led to the Lower Fox River PCB Cleanup Project in which responsible parties were required to pay for the $1 billion cleanup efforts, with active cleanup operations in place from 2009 to 2020. Over 8 million cubic yards of contaminated sediment was remediated, and long-term monitoring of fish tissue, surface water, and sediment will continue to track post-remediation recovery and overall project goals. An updated long-term monitoring schedule and results for all OUs can be found on the WDNR Lower Fox River PCB Cleanup Project website.

Additionally, in 2012 a USEPA-approved TMDL was established for the Lower Fox River basin, the goal of which is to meet water quality standards and provide meaningful water quality improvements at the mouth of the Fox River by reducing total phosphorus and total suspended solids loadings in the basin by 59% and 55%, respectively.

Through compliance with WPDES permits, point source dischargers and municipal separate storm sewer systems (MS4s) in the basin are expected to meet limits established in the TMDL resulting in the reduction of 131,500 lbs. of total phosphorus over the next several years. A current list of point source dischargers and MS4s can be found on the WDNR Lower Fox River Basin TMDL website.

These and several other landmark bi-national, national, state, and local policies, regulations and initiatives focused on reduction of point source discharges have resulted in dramatic improvements to water quality in the Fox River (see Appendix C for a list of relevant regulatory and voluntary initiatives). One example is drastic reductions to biological oxygen demand loads that have allowed a world-class walleye fishery to become re-established. Today, recreational sport fishing in Green Bay supports an estimated $264 million annually to the regional economy, generates $14.8 million annually in state and local tax revenue, and provides 2,711 full-time equivalent jobs (Winden and Stoll, 2019).

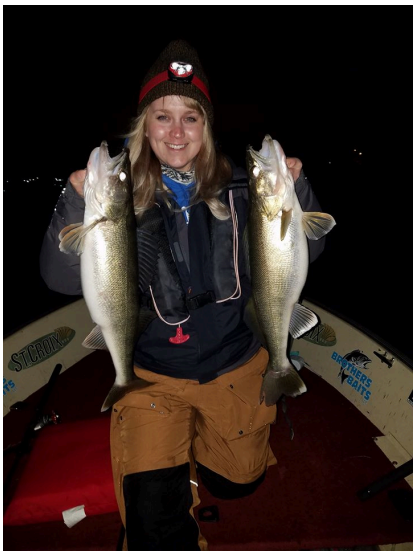

*Figure 3. Top Left Photo: Musky fishing on the Fox River (photo courtesy Jim Saric); Top Right and Bottom Photo: Walleye fishing on the Fox River (photo courtesy Amanda Smith and Anindo Choudhury)*

However, while great strides in the reduction of point source pollution have occurred over the last several decades, nonpoint source pollution stemming largely from agricultural practices in the Lower Fox River basin continues to contribute to aesthetic problems in the waters of the Lower Fox River and Green Bay, such as sediment plumes, algal blooms, and unpleasant odors. Because these pollutants are originating from a diffuse geographic area, they cannot be addressed by actions within the AOC boundaries alone. As such, the efforts to reduce nonpoint

source nutrient and sediment loading are largely coordinated through WDNRs Nonpoint Source Program (NPS) and part of the broader Lakewide Action and Management Plan (LAMP) initiatives for Lake Michigan that are being forwarded by many partners. Additionally, the Lower Fox River basin is named as an Agricultural Priority Watershed under Focus Area 3 of GLRI Action Plan 3.

The TMDL target for phosphorus and sediment inputs stemming from nonpoint agricultural practices calls for a reduction of 196,748 lbs. of total phosphorus and 55,570,968 lbs. of total suspended solids. As part of the effort to realize agricultural loading reductions, the development and implementation of 9 Key Element watershed plans for subwatersheds in the Lower Fox River basin began in 2015. The purpose of these plans is to assess contributing causes and sources of nonpoint source pollution, involve key stakeholders, and prioritize restoration and protection strategies to address water quality problems. Development and implementation of these plans is prioritized from the highest to lowest loading subwatersheds in the Lower Fox River basin. A current list of approved 9 Key Element watershed plans can also be found on the WDNR Lower Fox River Basin TMDL website.

These efforts have and will continue to address the following key actions identified in the original RAP:

- Key Action 1: Reduce phosphorus inputs to the river and bay from nonpoint and point sources
- Key Action 2: Reduce sediment and suspended solids inputs
- Key Action 5: Continue control of oxygen-demanding wastes (BOD) from municipal and industrial point source discharges
- Key Action 9: Reduce sediment resuspension

*Fish and Wildlife Habitat Improvements (Figure 4)*

Several examples of local, state, regional, and national initiatives to improve fish and wildlife habitat have been in place for decades. In 1996, the US Fish and Wildlife Service, part of the Department of Interior, began pursuing a Natural Resource Damage Assessment (NRDA) that assessed PCB-caused injuries to natural resources throughout the Lower Fox River and Green Bay and quantified damage in terms of financial accountability by potentially responsible parties for the PCB contamination. The NRDA was allowable under CERCLA and authorized the State of Wisconsin, State of Michigan, Menominee Indian Tribe of Wisconsin, Oneida Nation of Wisconsin, US Department of the Interior and US Department of Commerce to act as “Trustees” on behalf of the public in making decisions on restoration, rehabilitation, replacement, and/or acquisition of natural resources equivalent to those harmed by PCB releases. Since 2002, the Fox River Natural Resource Trustee Council have successfully recovered $90 million from parties responsible for PCB releases to support natural resource restoration projects (Fox River NRDA, 2020).

Reconstruction of the Cat Island chain began in 2012, and construction of a 2.5-mile wave barrier and side dikes for three islands was completed in 2013. The wave barrier restores protections from strong northeast wind, wave, and ice scour for 1,400 acres of shallow water and coastal wetland habitat. Additionally, over the next 20 to 30 years just over 270 acres of

island habitat will be restored in Green Bay that provides critical habitat for several endangered and threatened species and other important fish and wildlife populations.

In 2013, an Integrated Stream and Wetland Restoration project focused on the Duck-Pensaukee watershed to improve priority wetlands, tributaries, and riparian habitats with a focus on native migratory fish and wetland-associated wildlife. An interactive web map was designed to help conservation practitioners prioritize sites in the watershed for protection and restoration. In 2007, the Brown County Land and Water Conservation Department received grant funding from the National Fish and Wildlife Foundation, Great Lakes Restoration Initiative, and Fox River NRDA to restore northern pike populations in Green Bay. From 2007 to 2017, over 50 wetland restorations or fish passage impediment removals on streams and road ditches along Green Bay's west shore were completed.


*Figure 4.Top left shows the reconstruction of the Cat Island Chain in progress (photo credit Steve Seilo); Top right shows a spotted musky yearling being stocked in the Fox River as part of the Spotted Musky Population Enhancement Program with support from the Fox River NRDA (photo credit Kevin Naze); Bottom photo shows one of several pike spawning habitat restoration projects in the Suamico and Little Suamico watersheds with support from the Fox River NRDA (photo retrieved from Fox River NRDA).*

In 2020, the AOC Fish and Wildlife Habitat Technical Advisory Committee came to consensus on a list of management actions (e.g. habitat restoration projects) to implement to address the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations impairments. DNR shared a draft list in late 2020 with USEPA where it is in the process of being approved.

Once approved, WDNR will work with several partners to obtain GLRI funding and leverage other funding sources such as the Fox River NRDA to implement the projects on the management action list over the next several years.

These efforts and many others have and will continue to address the following key actions identified in the RAP:

- Key Action 6: Protect wetlands and manage habitat and wildlife
- Key Action 7: Reduce/control populations of problem fish
- Key Action 9: Reduce sediment resuspension

*Shoreline Redevelopment and Increased Public Access (Figure 5 - Figure 9)*

The aesthetic appeal of the river and that of the city are interconnected. Downtown areas deteriorated as manufacturing businesses closed, leaving blighted and contaminated sites (Tax Increment District (TID) 22 Project Plan: The Shipyard, 2019). However, as cleanup along the river has progressed over the last several decades, community members have begun to view the waterfront as a more desirable place to live and recreate. Over the past 25 years the Fox River waterfront has evolved from a primarily industrial area to a mixture of industrial, commercial, residential, and recreational areas (Port of Green Bay Economic Opportunity Study 2013).

This shift has resulted in a relatively recent competition between the trade, housing, and tourism industries for waterfront property, and made redevelopment of existing sites important (Lower Fox River and Green Bay Shoreline Waterfront Redevelopment Plan, 2010). The desire of the City and County to create a vibrant downtown with urban "villages" in the midst of an industrial area and major seaport resulted in a number of planning initiatives (Shipyard Neighborhood Investment Strategy, 2018), including:

- Downtown Green Bay Design Plan (1997, updated 2003) Downtown Green Bay Design Plan (1997, updated 2003)
- Near Downtown Neighborhoods Plan (1998)
- Green Bay Smart Growth 2022 Comprehensive Plan (2003)
- Brown County Comprehensive Plan – A Vision for Great Communities (2004) (2004)
- Lower Fox River and Green Bay Shoreline Waterfront Redevelopment Plan (2010)
- AuthentiCity Downtown Master Plan (2014)
- Neighborhood Master Plan for Broadway District (2014; not adopted)
- Green Bay Waterfront Plan 2015 (2003; not adopted)

The Lower Fox River and Green Bay Shoreline Waterfront Redevelopment Plan (Brown County, 2010) identified twelve distinct "opportunity areas" along the Fox River from the bay of Green Bay to the De Pere Dam (Brown County Planning Commission, 2010). Four of these were recommended to remain primarily for port-related and/or industrial uses, while the others were to be encouraged to transition from industrial to mixed uses (Port of Green Bay Economic Opportunity Study, 2013).

Although actions in the AOC focus on the aesthetics of the river, e.g. debris or scum in the water, urban blight is a serious aesthetic problem, particularly in industrial areas such as along

the Fox River waterfront. Like many other industrial cities, Green Bay was forced to transform its manufacturing-based economy toward a service-based economy in the late 20th century. Many residents became unemployed and the industrial properties became brownfield sites posing an environmental risk and blocking public access to the river (TID 22 Project Plan: The Shipyard, 2019). Vacant or underused buildings, deteriorating structures, and crumbling streets all detract from the appearance and habitability of urban areas.

*Figure 5. Top photo: Birds-eye view of downtown Green Bay taken from the top of the St. Willebrord's Catholic Church overlooking the Washington Street Fox River waterfront in 1889. (Wisconsin Historical Society, Frederick Straubel, Industrial Waterfront and Fox River, 31911. Viewed online at https://www.wisconsinhistory.org/Records/Image/IM31911); Bottom photo: 2014 aerial image of downtown Green Bay overlooking the Fox River waterfront along Washington Street (photo courtesy Christopher Rand)*

One way in which Brown County and the City of Green Bay have addressed urban blight is through the creation of Tax Increment Districts (TIDs) to finance projects in areas that are at least 50% blighted. Tax Increment Finance (TIF) is a tool in which (in accordance with Wisconsin statute 66.1104(f)), taxes paid on the incremental value of a property are allocated to the City to pay the costs of redevelopment projects. From 1998 to 2008, six waterfront TID improvement plans were created (City of Green Bay website, 2020):

- TID 4 Downtown (1998) – Infrastructure improvements, streetscaping, and redevelopment in areas along the east bank of the Fox River, including mixed-use residential, office/retail and commercial developments, construction of the Fox River Parkway, and renovation of the Fox Theatre.
- TID 5 East and West Downtown (1998) – Improvement projects on the east and west sides of the Fox River, including retail/commercial, mixed-use residential, office, and hotel development; riverfront walkway, pedestrian ramp, and boat dock construction, and park development.
- TID 13 Downtown Redevelopment (2003) – Infrastructure and utility improvements to 26 acres east of the Fox River.
- TID 13 Amendment (2005) – Demolition of the abandoned Washington Commons Mall structure and re-establishment of the street network.
- TID 14 North Broadway Redevelopment (2006) – Street extensions, utility installation, infrastructure improvements, property acquisition, and historic preservation of structures from Fort Howard and Fort LaBaie.
- TID 17 900 North Broadway (2008) – Demolition of collapsing condemned warehouses and blighted residential parcels, and preparation of the sites for redevelopment.

As contaminated sediment removal efforts in the Lower Fox River and Green Bay were nearing a close and as the redeveloped and improved areas in downtown matured, four more plans were adopted for the waterfront in the last two years:

- TID 21 Green Bay Packaging (2018) – Property acquisition and site preparation, infrastructure improvements, and addition of amenities such as paved trails, pocket parks, landscaping, public art, etc.
- TID 13 Amendment (2019) – Acquisition of a parking lot to meet the increased need resulting from other housing, office, and retail developments.
- TID 14 Amendment (2019) – Addition of several adjacent blighted parcels to TID 14, and name change to The Railyard.
- TID 22 Shipyard (2019) – Remediation of brownfields and re-purposing of underused structures, with the goal of attracting a developer to construct a signature waterfront outdoor recreation and entertainment area on the west bank of the Fox River.

Almost all TID improvement plans included infrastructure improvements and streetscaping. Infrastructure improvements included the construction and upgrading of sanitary and stormwater sewers, contributing to better water quality; streetscaping included landscaping and tree planting. Several of the TID plans above included construction of parks and walkways and addition of amenities specifically to improve the area aesthetics, such as public art, banners, and new bus shelters.

In addition to urban redevelopment efforts focused on transforming what was once a largely manufacturing-dominated shoreline contributing to urban blight, there has also been a major effort to provide more public access and greenspace along the AOC shoreline. John Nolen created a Plan in 1921 for the Green Bay “Downtown” which was coined as the *Nolen Plan* (*AuthentiCity*, 2014). The *Nolen Plan* highlighted the need to improve utilization of the riverfront stretching from Walnut to Main Street as there were no public spaces located along the river at this time except for a public boat landing. Since then, several municipalities have worked for

decades upgrading portions of the Fox River shoreline into parks and public green spaces to soften the scenery by creating open views of built and natural environments.

Some examples of large parks that provide access, event space, and views of the riverfront include Leicht Memorial Park, Ashwaubomay Park, and Voyageurs Park (Figure 6).

*Figure 6. Top: Leicht Memorial Park during a Tall Ships Festival (courtesy Greater Green Bay CVB); bottom left: Ashwaubomay Park (courtesy Brie Kupsky); bottom right: Voyageur Park (courtesy Greater Green Bay CVB).*

In addition to public park space, trails extend along the east and west shoreline of the Fox River allowing for a functional and regional trail system. The Fox River State Recreational Trail follows 25 miles of the Fox River shoreline from downtown Green Bay and connects to another 6 miles of trail along the East River (Figure 7). Several pedestrian walking paths are located on the west shore of the Fox River and improved access continues to be a local priority.

Another public resource in Green Bay's Downtown is the CityDeck, a nationally recognized centerpiece that provides the community a place to gather within the trail system from Main Street to Walnut Street (Figure 7). The CityDeck has increased the development of the downtown's east side through economic activity and private investment.

*Figure 7.Top: Green Bay CityDeck (photo courtesy City of Green Bay); bottom left: Fox River State Recreational Trail (photo courtesy Friends of the Fox River Trail); bottom right: Yoga on the CityDeck event (photo courtesy City of Green Bay)*

In addition to significant recreation and access opportunities along the Fox River, several opportunities exist along nearshore areas of Green Bay. Examples on the east shore include Bay Beach, the University of Wisconsin (UW)-Green Bay Arboretum, Joliet Park, and Pt. au Sable, while the Ken Euers Nature Area, Barkausen Waterfowl Preserve and Fort Howard Wildlife Area, and the Green Bay West Shores Wildlife Area provide ample public access and recreation opportunities along the west shore (Figure 8). Finally, several public boat launches and fishing piers provide access to the Fox River and Green Bay fishery.

*Figure 8. Top left: Bay Beach Amusement Park (photo courtesy of Green Bay); top right: the Cofrin Memorial Arboretum (photo courtesy UW-Green Bay); bottom left: Ken Euers Nature Area (photo courtesy UW-Green Bay); bottom right: Longtail Point (photo courtesy Brie Kupsky)*

Today, much of the Fox River shoreline is publicly owned and several public lands exist along the Green Bay shoreline of the AOC (Figure 9), in stark comparison to the nearly complete lack of public access and recreation points along the Fox River in 1921 described by the *Nolen Plan*.

These efforts and many others in the Green Bay area address the following key actions identified in the RAP:

- Key Action 6: Protect wetlands and manage habitat and wildlife
- Key Action 14: Enhance public and private shoreline uses

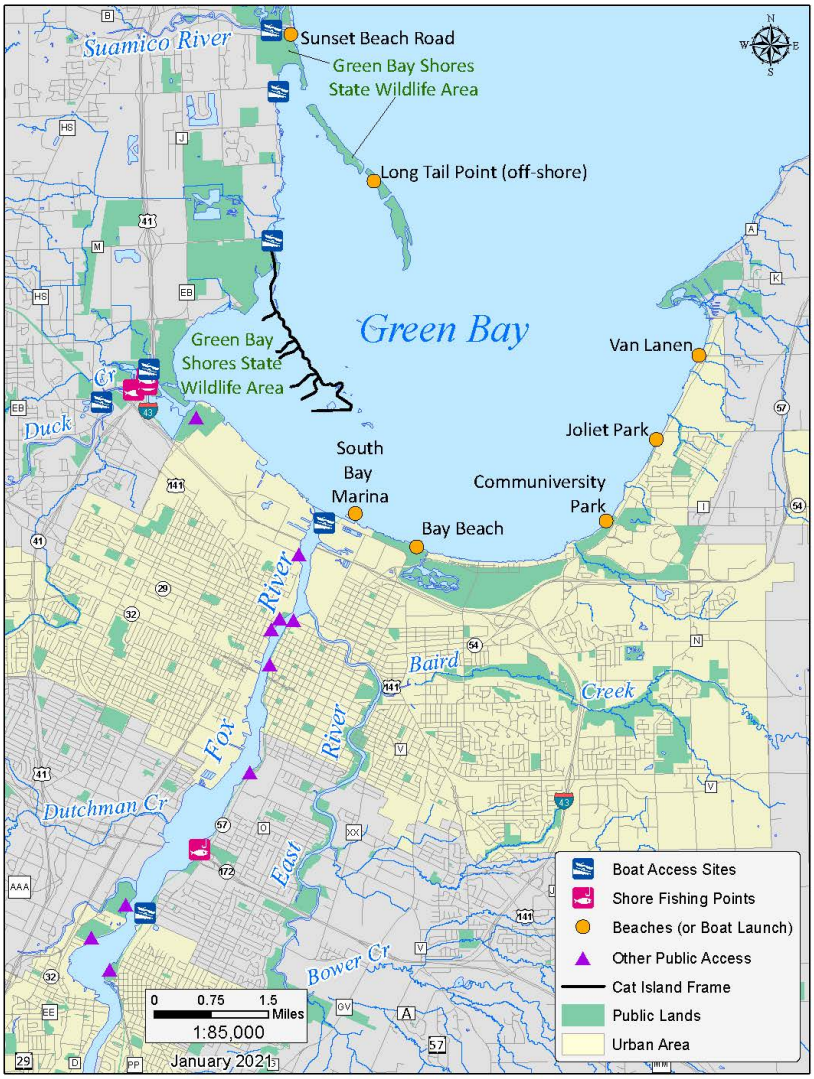


*Figure 9. Map showing various public access points and public lands along the Fox River and Green Bay shoreline. Another excellent resource for exploring recreation, public access, and other coastal features can be found on the Wisconsin Coastal Guide online story map from UW Seagrant.*

These improvements have, in part, led to publications such as U.S. News and World Report Best Places to Live in the U.S. which lists Green Bay as #25 out of 150 metro areas evaluated overall, and #6 out of 150 for "overall quality of life". As investments in redevelopment and recreational opportunities along the shoreline and nearshore areas of the AOC continue, we can expect to realize more benefits of an aesthetically pleasing waterfront such as increased tourism, economic growth, and greater use of and appreciation for the water by local residents.

# Volunteer Aesthetic Monitoring Program Results

*Background*

While several partners such as GBMSD collect water quality data at several locations throughout the AOC, information required to evaluate the aesthetic parameters detailed in the BUI removal target (floating or submerged debris, oil, scum, materials producing color, odor, taste, or unsightliness, etc.) is generally not collected through existing sampling efforts. Decisions about the aesthetic quality of water are also subjective in nature and involve personal interpretation of what is an “unacceptable level” or an “objectionable amount” that would interfere with public rights or impair use. As such, to evaluate the status of this impairment relative to the BUI removal target, WDNR established a Volunteer Aesthetic Monitoring Program in 2011 to collect monitoring data and/or survey data within the AOC. The project had two distinct phases: Phase 1 was carried out from 2011 to 2013 at 10 selected survey stations across the AOC, and Phase 2 from 2015 to 2018 at 12 selected survey stations to give a broad overview of public perception of aesthetic value. Survey stations were determined in consultation with an AOC Advisory Committee and considered safety concerns and geographic spread across the AOC.

*Phase 1 (2011 – 2013) Project Objectives and Methods*

The main project objectives included:

1. Expand public participation in the AOC through monitoring and clean-up days
2. Identify factors, if any, contributing to degraded aesthetics in the AOC
3. Use the results to define projects to improve aesthetics at specific locations
4. Evaluate the current status of AOC aesthetics relative to the delisting targets

The survey asked a series of questions that generated numeric “action criteria” intended to help quantify the overall impression of aesthetic condition at each survey site, as well as the degree to which objectionable substances could prevent respondents from accessing, enjoying, or using the water. From each survey form, an “aesthetic impression” action criteria score was generated from responses in which surveyors described their first impression of the site, ranging from very pleasing (0), pleasing (1), neither pleasing nor displeasing (2), displeasing (3), to very displeasing (4). This score was averaged across each year to get an overall aesthetic impression score for each survey station.

The datasheet also generated an integrated “aesthetic assessment” action criteria score that evaluated individual assessments to better assess potential issues at each survey location. The score ranged from 0 to 10 in which points were tallied for questions where respondents indicated that the presence of various materials, substances, or other shoreline or in-water parameters that could potentially make the area “unpleasant” or block the ability to access or use the water. These scores were also averaged across each year to get an overall aesthetic assessment score for each survey station, with lower scores indicating that the site had fewer objectionable substances present.

Finally, each survey site was assessed for specific needs to improve aesthetic quality by calculating the percentage of surveys in which survey respondents indicated objectionable

substances were present at levels great enough to be considered unpleasant or block the ability to access or use the water.

Local volunteers were recruited and trained on project objectives, sampling methods, and the WDNR Surface Water Integrated Monitoring System (SWIMS) database. Each volunteer was asked to visit a minimum of three stations (Figure 10) at least once during 2 different monitoring seasons (spring - April/May, summer – June/July/August, fall – September/October) to complete the survey including observations and water quality questions.

Volunteers were also supplied with a monitoring equipment kit to collect water transparency data and digital cameras to further capture important features at the survey stations. The impetus for asking volunteers to visit the same survey stations more than once was to capture how different environmental/seasonal conditions could impact perception of aesthetic value (e.g. spring runoff, high heat, etc.).

Volunteers returned the completed surveys by mail, fax, email or in person to the AOC Coordinator. These surveys were reviewed to ensure they met the quality control requirements before they were uploaded to the SWIMS database. Quality control requirements and the corresponding data sheet can be found in the 2011-2013 Volunteer Aesthetics Monitoring Quality Assurance Project Plan (QAPP) in Appendix D.


*Figure 10. 2011-2013 Phase 1 Volunteer Aesthetic Monitoring Program survey stations.*

To provide a more direct evaluation of the BUI removal target, action criteria thresholds were established in the QAPP (Table 1) with the presence of one or more sites consistently exceeding all three action criteria for any given year indicating some necessary management and/or action (e.g. community clean-up days, placement of garbage cans, discouraging congregation of animals, runoff reduction, etc.). Aesthetic impression action criteria scores averaging a 3 or higher would indicate that the majority of respondents considered the site to be "displeasing" overall; aesthetic assessment action criteria scores averaging a 5 or higher would indicate that a majority of respondents indicated that at least 5 out of the 10 possible displeasing substances were present at the site; and any objectionable substances averaging 75% or greater would indicate that a majority of respondents indicated that the substance was present at levels great enough to be considered unpleasant or block the ability to access or use the water. These action criteria thresholds were determined in consultation with stakeholders.

*Table 1. Action criteria for a site-based management action developed for every monitoring year*

| Year | Aesthetic Impression | Assessment Score | Percentage surveys indicating objectionable substance(s) |
|---|---|---|---|
| 2011-2013 | ≥ 3 | ≥ 5 | ≥ 75% |

The final project report was presented to AOC stakeholders, including a more detailed analysis and recommendations for each survey station across the entire survey period (Appendix E). The report and discussions with stakeholders were used to revise the Volunteer Aesthetics Monitoring program by applying lessons learned from the 2011 – 2013 survey period and enhance consistency between the survey programs in the Lower Green Bay & Fox River and Milwaukee Estuary AOCs.

*Phase 1 (2011 and 2013) Project Results*

A total of 60 surveys were completed that met quality control requirements in the 2011 – 2012 survey period; very little survey data collected in 2013 met quality control requirements and are not included in the analysis (Table 2). Given the low number of observations, data from the 2011 and 2012 survey years were evaluated collectively.

*Table 2. Volunteer Aesthetic Monitoring Program Results: Total surveys completed from 2011-2012 at all survey stations.*

| **Station** | **Total Surveys (2011-2012)** |
|---|---|
| Bay Beach | **6** |
| Communiversity Park | **4** |
| Fox Point Boat Launch | **4** |
| Leicht Park | **8** |
| Metro Boat Launch | **9** |
| Perkofski Boat Launch | **2** |
| Porlier Park | **6** |
| Riverview Place Park | **7** |

| | |
|---|---|
| Voyageur Park | **7** |
| West Lazarre Avenue | **7** |
| **Total** | **60** |

Overall aesthetic impression averaged a score of 2.9 across all survey stations, coming close to exceeding the 3.0 aesthetic impression action criteria threshold. More specifically, Bay Beach, Perkofski Boat Launch, Porlier Pier, Riverview Place Park, and West Lazarre Avenue average scores were equal to, or exceeded, the action criteria threshold of ≥ 3 (Figure 11).

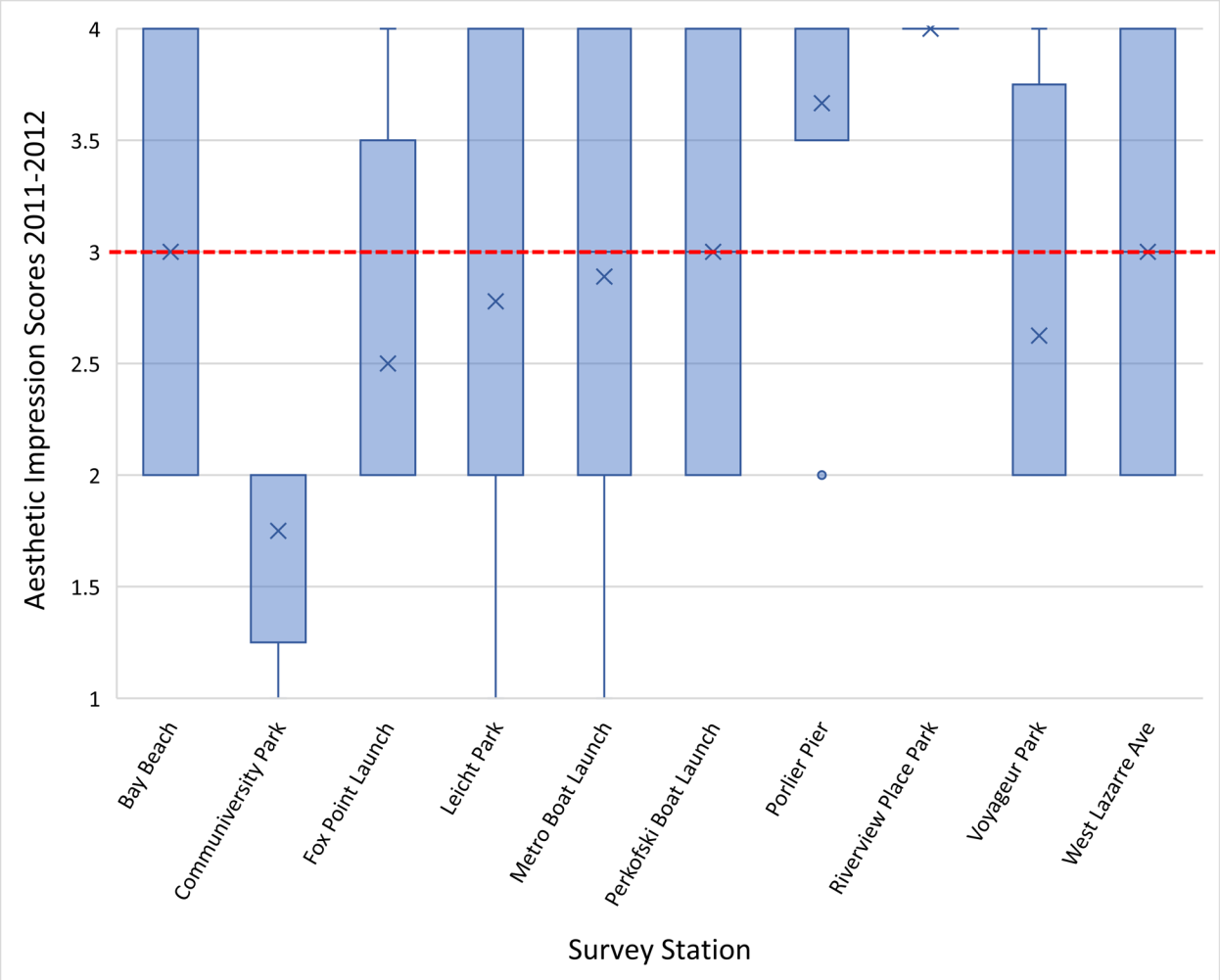


*Figure 11. 2011-2012 Volunteer Aesthetic Monitoring Program Results: Aesthetic Impression Scores. Box and whisker plots of the Aesthetic Impression scores for sites in 2011 and 2012. The whiskers represent the lowest and highest data values; the bottom and top of each box represent the 25$^{th}$-75$^{th}$ percentiles of the values; the X is the average of the data and the line is the median; dots are outliers. Missing whiskers indicate that the lowest or highest value is repeated; a missing median line indicates that the median value is the same as the lowest or highest value. The red dashed line indicates the action criteria threshold.*

Overall aesthetic assessment scores averaged 2.7 among all survey locations, with Riverview Place Park being the only location to exceed the action criteria threshold of ≥ 5 (Figure 12).

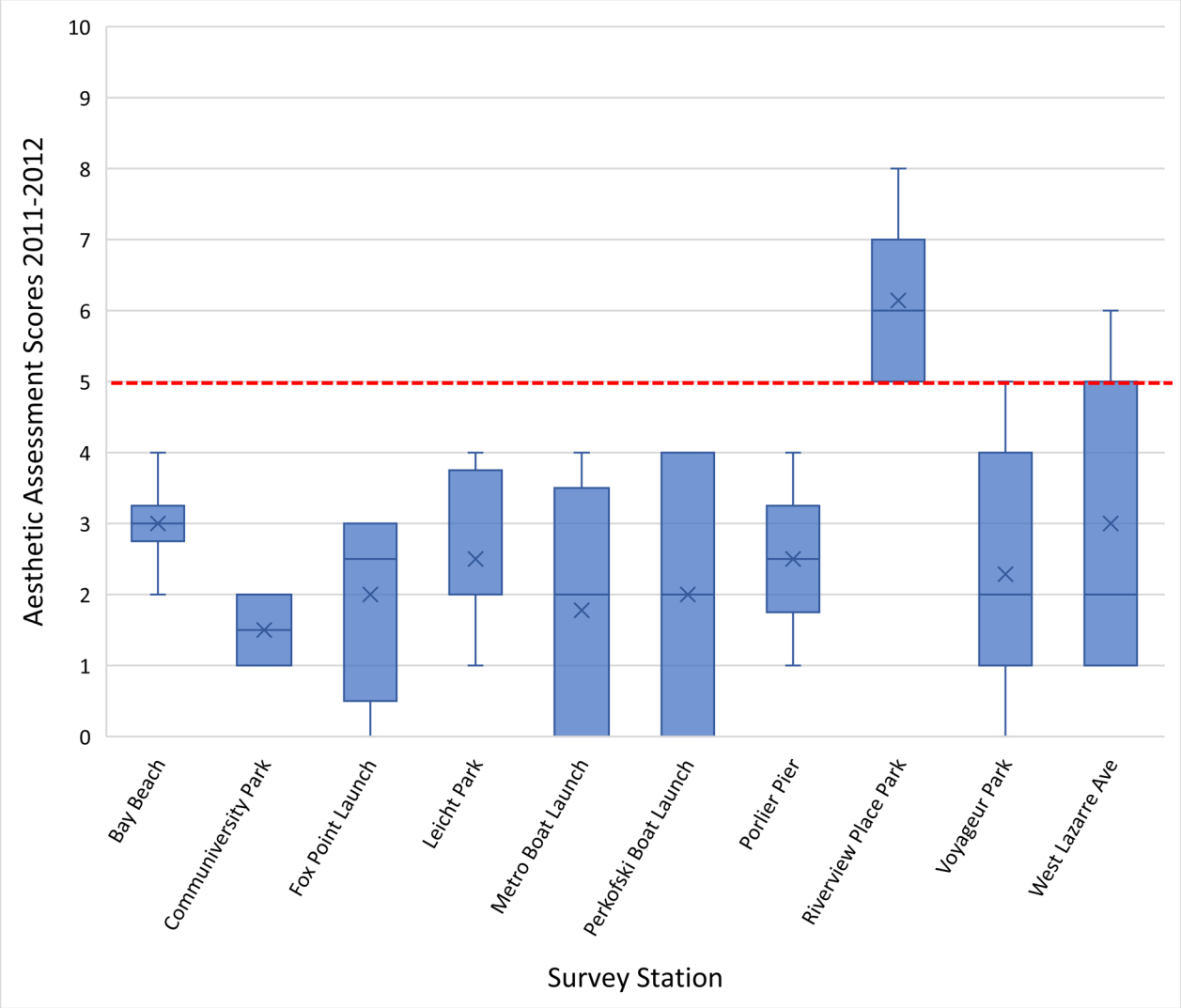


*Figure 12. 2011-2012 Volunteer Aesthetic Monitoring Program Results: Aesthetic Assessment Scores. The red dashed line indicates the action criteria threshold. The whiskers represent the lowest and highest data values; the bottom and top of each box represent the 25$^{th}$-75$^{th}$ percentiles of the values; the X is the average of the data and the line is the median; dots are outliers. Missing whiskers indicate that the lowest or highest value is repeated; a missing median line indicates that the median value is the same as the lowest or highest value.*

The percentages of surveys indicating that the following substances were present at levels high enough to be considered unpleasant or to block respondents' ability to access or enjoy the water are presented below in Table 3; Bay Beach, Communiversity Park, Leicht Park, and Riverview Place Park were sites in which at least one parameter exceeded the action criteria threshold of ≥ 75% when averaging survey responses across individual sites.

*Table 3. 2011-2012 Volunteer Aesthetic Monitoring Program Survey Results: The number of surveys collected at each station is included in parenthesis next to the station name. Objectionable Substances indicated in ≥ 75% of surveys to be present at levels great enough to be considered unpleasant or block the ability to access or use the water are identified in red.*

| Station | Animals | Materials | Dead Animals | Invasive Species | Other Shoreline Materials | Submerged Garbage | Floating Algae | Shoreline Garbage | Floating Garbage | Other Floating Materials | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bay Beach (6)** | 16.7 | 100.0 | - | 100.0 | - | - | - | 83.3 | - | - | **30.0** |
| **Communiversity Park (4)** | 25.0 | - | - | 100.0 | - | - | 25.0 | - | - | - | **15.0** |
| **Fox Point Boat Launch (4)** | 25.0 | 25.0 | - | 25.0 | 25.0 | - | 50.0 | 50.0 | - | - | **20.0** |
| **Leicht Park (8)** | 37.5 | 75.0 | - | - | - | - | 87.5 | 37.5 | 12.5 | - | **25.0** |
| **Metro Boat Launch (9)** | 44.4 | 22.2 | 11.1 | 11.1 | - | - | 33.3 | 44.4 | 11.1 | - | **17.8** |
| **Perkofski Boat Launch (2)** | 50.0 | 50.0 | - | - | 50.0 | - | 50.0 | - | - | - | **20.0** |
| **Porlier Pier (6)** | 16.7 | 50.0 | - | - | - | 50.0 | 66.7 | 66.7 | - | - | **25.0** |
| **Riverview Place Park (7)** | - | 100.0 | 28.6 | 100.0 | 42.9 | 100.0 | 100.0 | 100.0 | 28.6 | 14.3 | **61.4** |
| **Voyageur Park (7)** | 14.3 | 42.9 | 14.3 | 14.3 | 14.3 | - | 57.1 | 42.9 | 28.6 | - | **22.9** |
| **West Lazarre Avenue (7)** | - | 57.1 | 16.7 | 42.9 | - | 42.9 | 71.4 | 71.4 | - | - | **30.2** |
| **Average** | **23.0** | **52.2** | **7.1** | **39.3** | **13.2** | **19.3** | **54.1** | **49.6** | **8.1** | **1.4** | |

Overall, while some action criteria thresholds were exceeded at individual survey stations, none of the 10 survey stations exceeded all three action criteria in the 2011-2012 survey period (Table 4). However, it is important to note that the 2011-2012 survey years had a low sample size, making it difficult to draw conclusions about the true aesthetic condition of each location and across the AOC more broadly.

*Table 4. 2011-2012 Volunteer Aesthetic Monitoring Program Survey Results: Total action criteria threshold exceedances by survey station.*

| Station | Average Aesthetic Impression Score ≥ 3 | Average Aesthetic Assessment Score ≥ 5 | ≥ 75% surveys indicating objectionable substance(s) | Total # Action Criteria Exceeded |
|---|---|---|---|---|
| **Bay Beach** | X | | X | **2** |
| **Communiversity Park** | | | X | **1** |
| **Fox Point Boat Launch** | | | | **0** |
| **Leicht Park** | | | X | **1** |
| **Metro Boat Launch** | | | | **0** |
| **Perkofski Boat Launch** | X | | | **1** |
| **Porlier Pier** | X | | | **1** |
| **Riverview Place Park** | X | | X | **2** |
| **Voyageur Park** | | | | **0** |
| **West Lazarre Avenue** | X | | | **1** |
| **Total** | **5** | **0** | **1** | |


*Photo taken at the Porlier Pier Canoe Launch during a 2012 Volunteer Aesthetic Monitoring Program survey (credit Nic Sparacio).*

*Phase 2 (2015 – 2018) Project Objectives and Methods*

The 2015-2018 Volunteer Monitoring Project incorporated lessons learned from the pilot project and expanded the number of survey sites to 12 to better address even distribution throughout the AOC, safety concerns, and public access considerations (Figure 13).

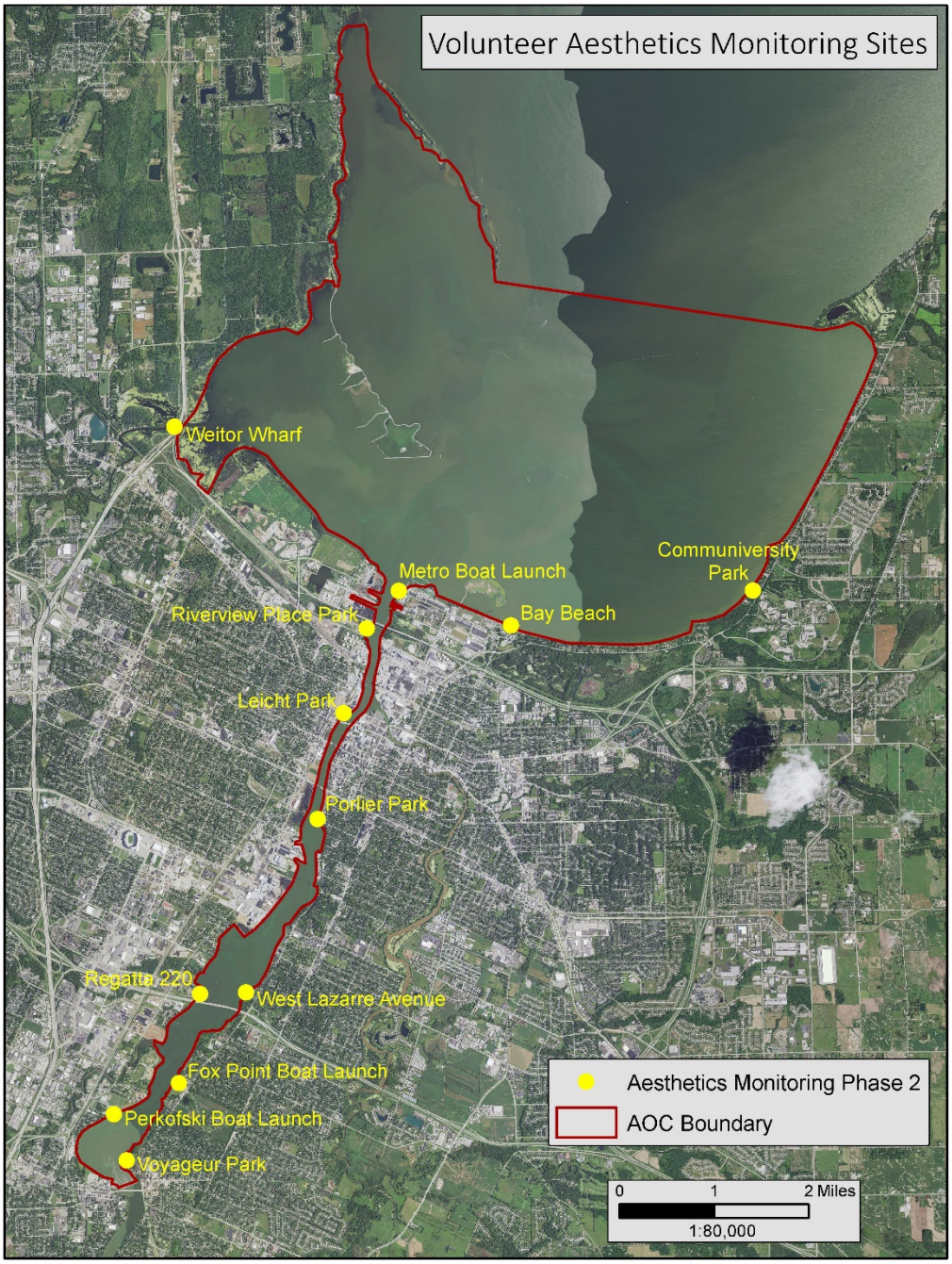


*Figure 13. Map showing the 2015-2018 Volunteer Aesthetic Monitoring Program survey stations.*

The main project objectives of the Phase 2 survey period include:

1. Evaluate the current status of AOC aesthetics relative to the delisting targets;
2. Identify factors, if any, contributing to degraded aesthetics in the AOC;
3. Where feasible, use the results to define projects to improve aesthetics at specific locations;
4. Expand public participation in the AOC through monitoring.

One takeaway from the 2011-2013 survey period was better volunteer coordination was needed to generate an adequate number of surveys for the BUI assessment. Therefore engagement, training, and coordination of volunteers throughout the 2015 – 2018 survey period was led by multiple local organizations, including UW-Extension, UW-Fox Valley, and the Fox Wolf Watershed Alliance.

As in the Phase 1 survey period, the Phase 2 survey asked a series of questions intended to help quantify the overall impression of aesthetic condition at each survey site ranging from very pleasing (0), pleasing (1), neither pleasing nor displeasing (2), displeasing (3), to very displeasing (4). This score was averaged across all years to get an overall aesthetic impression score for each survey station.

An “aesthetic assessment” score was also generated, though the Phase 2 survey included fewer objectionable substances than the Phase 1 survey for respondents to indicate would prevent them from accessing, enjoying, or using the water. Objectionable substances evaluated included: **Water Color/Clarity**, **Floating/Submerged Garbage** in water and/or on shoreline, **Other Substances** in water and/or on shoreline, **Animal-related Problems**, and **Nuisance Vegetation**. Scores were tallied and ranged from 0 to 7 and were averaged across each year to get an overall aesthetic assessment score for each survey station, with lower scores indicating that the site had fewer objectionable substances present. The number of objectionable substances identified by observers was also compared to the overall Aesthetic Impression score.

Finally, each survey site was assessed individually by calculating the percentage of surveys in which objectionable substances were indicated by survey respondents to be present at levels great enough to impede access, enjoyment, or use of the water or shoreline.

As in the Phase 1 survey period, aesthetic impression action criteria scores averaging 3 or higher would indicate that the majority of respondents considered the site to be “displeasing” overall (Table 5). However, one notable difference between the Phase 1 and Phase 2 survey periods was the difference in action criteria threshold for aesthetic assessment scores given the smaller number of questions to tally in the Phase 2 surveys (Table 5). Therefore, aesthetic assessment action criteria scores averaging a 4 or higher would indicate that a majority of respondents indicated that at least 4 out of the 7 possible displeasing substances were present at the site, and objectionable substances averaging 75% or greater would indicate that a majority of respondents indicated that the substance was present at levels great enough to impede access, use or enjoyment of the site (Table 5). As in the Phase 1 survey period, the presence of one or more sites consistently exceeding all three action criteria for any given year also indicated some necessary management and/or action for the Phase 2 survey period (e.g. community clean-up days, placement of garbage cans, discouraging congregation of animals, runoff reduction, etc.).

*Table 5. Action criteria limit for a site-based management action in 2011-2012 and 2015-2018 survey periods.*

| Year | Aesthetic Impression | Assessment Score | Percentage surveys indicating objectionable substance(s) |
|---|---|---|---|
| **2011-2013** | ≥ 3 | ≥ 5 | ≥ 75% |
| **2015-2018** | ≥ 3 | ≥ 4 | ≥ 75% |

After training, volunteers were supplied the survey data sheet, monitored stations throughout the survey season, and returned the data sheets to the relevant volunteer monitoring coordinator organization. Completed surveys were then sent to the AOC Coordinator and reviewed for quality control requirements, and original copies of the survey forms were scanned and uploaded into the SWIMS database. A full description of quality control requirements and corresponding data sheet can be found in the 2015 Volunteer Aesthetics Monitoring QAPP Appendix F.

*Phase 2 (2015 – 2018) Project Results*

A total of 480 surveys were completed that met quality control requirements, with all survey stations meeting the 30 independent monitoring observations needed to evaluate results by year as outlined in the quality assurance project plan (Table 6).

*Table 6. 2015-2018 Volunteer Aesthetic Monitoring Program Results: Total surveys completed at all survey stations.*

| Station | 2015 | 2016 | 2017 | 2018 | Total |
|---|---|---|---|---|---|
| Bay Beach | 5 | 14 | 8 | 12 | **48** |
| Communiversity Park | 5 | 12 | 7 | 12 | **43** |
| Fox Point Boat Launch | 10 | 11 | 1 | 24 | **66** |
| Leicht Park | 8 | 8 | 4 | 24 | **55** |
| Metro Boat Launch | 6 | 13 | 8 | 13 | **54** |
| Perkofski Boat Launch | 9 | 6 | 6 | 12 | **44** |
| Porlier Park | 9 | 11 | 5 | 12 | **46** |
| Regatta 220 | 8 | 10 | 5 | 12 | **35** |
| Riverview Place Park | 7 | 12 | 5 | 12 | **45** |
| Voyageur Park | 10 | 16 | 19 | 13 | **78** |

| | | | | | |
|---|---|---|---|---|---|
| Weitor Wharf | 4 | 8 | 4 | 25 | **41** |
| West Lazarre Avenue | 8 | 10 | 5 | 12 | **51** |
| **Total** | **89** | **131** | **77** | **183** | **480** |

*Aesthetic Impression Scores*

Overall Aesthetic Impression scores averaged 1.4 with a median of 1 across all survey stations, with no stations exceeding the action criteria threshold of ≥ 3 (Figure 14). These results indicate that respondents considered survey locations in the AOC to be generally "pleasing" to "neither pleasing nor displeasing".

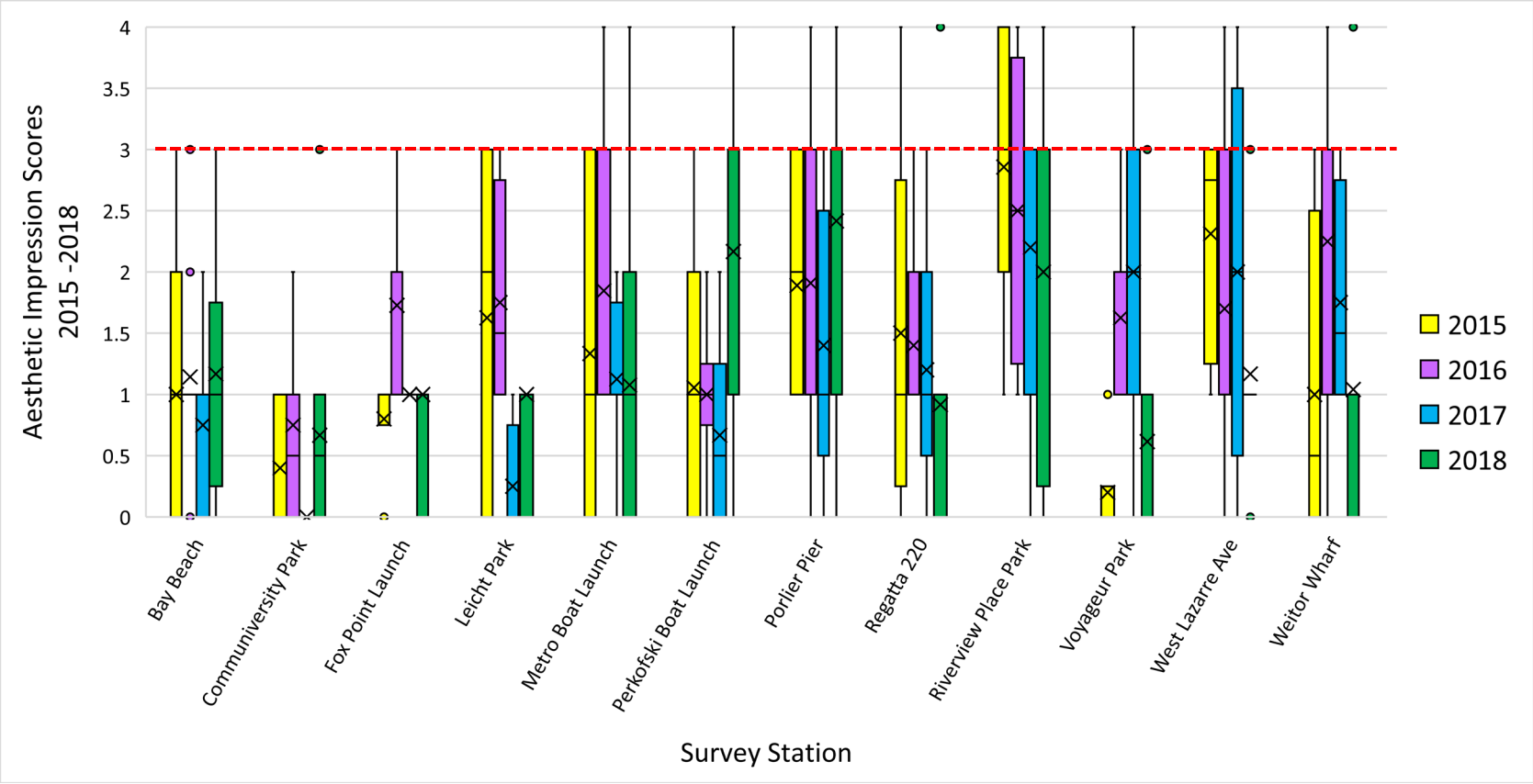


*Figure 14. 2015-2018 Volunteer Aesthetic Monitoring Program Results: Aesthetic Impression Scores. The red dashed line indicates the action criteria threshold. The whiskers represent the lowest and highest data values; the bottom and top of each box represent the 25$^{th}$-75$^{th}$ percentiles of the values; the X is the average of the data and the line is the median; dots are outliers. Missing whiskers indicate that the lowest or highest value is repeated; a missing median line indicates that the median value is the same as the lowest or highest value.*

*Aesthetic Assessment Scores*

Overall Aesthetic Assessment scores averaged 1.1 with a median of 1 across all survey locations, with no survey locations exceeding the action criteria threshold of ≥ 4 (Figure 15). These results indicate that respondents generally described at least 1 substance to be present at levels that would impede access, use, or enjoyment at survey locations.

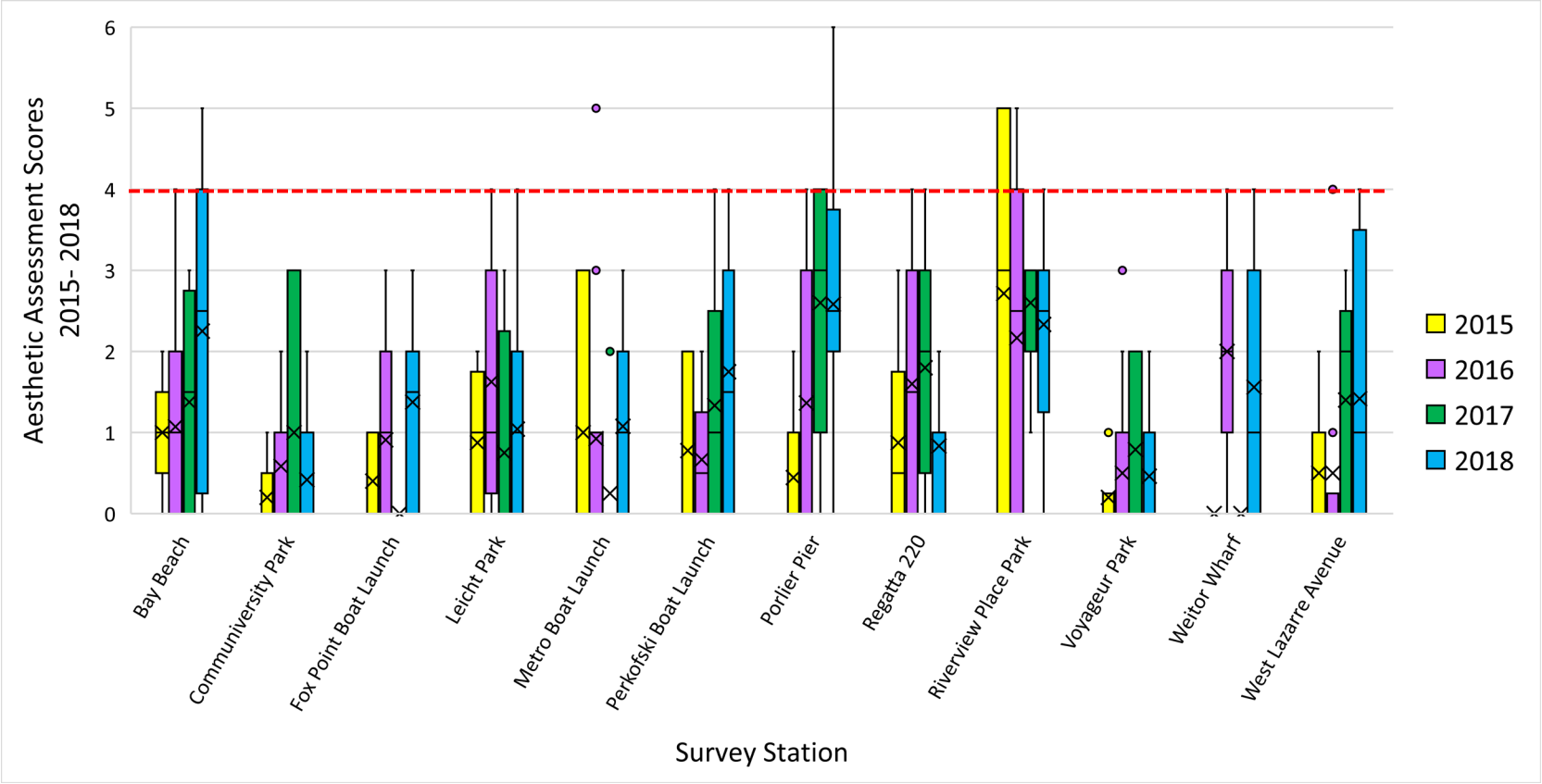


*Figure 15. 2015-2018 Volunteer Aesthetic Monitoring Program Results: Aesthetic Assessment Scores. The red dashed line indicates the action criteria threshold. The whiskers represent the lowest and highest data values; the bottom and top of each box represent the 25th-75th percentiles of the values; the X is the average of the data and the line is the median; dots are outliers. Missing whiskers indicate that the lowest or highest value is repeated; a missing median line indicates that the median value is the same as the lowest or highest value.*

*Objectionable Substance Percentages*

Objectionable substances indicated by survey respondents as present at levels great enough to impede access, enjoyment, or use of the water or shoreline averaged 16.0% with a median score of 8.3% across all survey locations. None of the survey averages for any station exceeded the action criteria threshold of ≥ 75% for any objectionable substance evaluated (Table 7).

*Table 7. 2015-2018 Volunteer Aesthetic Monitoring Program Survey Results: The number of surveys collected at each station is included in parenthesis next to the station name. Objectionable Substances indicated in ≥ 75% of surveys to be present at levels great enough to be considered unpleasant or block the ability to access or use the water are identified in red.*

| Station | Water Color/Clarity | Floating/Submerged Garbage in Water | Other Substances in Water | Shoreline Garbage | Animal-related Problems | Nuisance Vegetation | Other Shoreline Substances | Average |
|---|---|---|---|---|---|---|---|---|
| **Bay Beach (48)** | 29.9% | 8.0% | 15.1% | 30.4% | 4.2% | 30.7% | 24.2% | **20.3%** |
| **Communiversity Park (43)** | 17.6% | 0.0% | 2.1% | 5.7% | 6.3% | 7.7% | 15.7% | **7.9%** |
| **Fox Point Boat Launch (66)** | 32.6% | 4.4% | 2.3% | 7.5% | 5.4% | 10.6% | 4.4% | **9.6%** |
| **Leicht Park (55)** | 39.6% | 6.3% | 12.5% | 18.8% | 16.7% | 0.0% | 13.5% | **15.3%** |
| **Metro Boat Launch (54)** | 30.7% | 3.8% | 3.8% | 21.8% | 13.4% | 3.8% | 3.8% | **11.6%** |
| **Perkofski Boat Launch (44)** | 33.3% | 10.4% | 2.1% | 16.7% | 44.4% | 4.2% | 2.1% | **16.2%** |
| **Porlier Pier (46)** | 48.7% | 22.2% | 10.8% | 37.8% | 15.6% | 15.2% | 24.5% | **25.0%** |
| **Regatta 220 (35)** | 48.1% | 8.1% | 0.0% | 20.4% | 22.1% | 14.4% | 14.6% | **18.2%** |
| **Riverview Place Park (45)** | 35.9% | 36.5% | 21.7% | 60.8% | 4.2% | 54.5% | 31.7% | **35.1%** |
| **Voyageur Park (78)** | 27.3% | 1.6% | 4.4% | 7.2% | 0.0% | 1.6% | 6.7% | **7.0%** |
| **Weitor Wharf (41)** | 19.5% | 19.4% | 5.1% | 25.6% | 0.0% | 14.3% | 5.1% | **12.7%** |
| **West Lazarre Avenue (51)** | 25.4% | 2.1% | 7.1% | 34.2% | 2.1% | 16.9% | 8.0% | **13.7%** |
| **Average** | **32.4%** | **10.2%** | **7.3%** | **23.9%** | **11.2%** | **14.5%** | **12.9%** | **16.0%** |

*Lower Green Bay & Fox River Aesthetics Monitoring Program Results Discussion*

In conclusion, while some stations were observed to exceed action criteria thresholds in the 2011-2012 survey period, none of the stations exceeded all three action criteria and the 2015-2018 survey results observed no stations exceeding any of the three action criteria thresholds (Table xx).

*Table 8. 2015-2018 Volunteer Aesthetic Monitoring Program Survey Results: Total action criteria threshold exceedances by survey station.*

| Station | Average Aesthetic Impression Score ≥ 3 | Average Aesthetic Assessment Score ≥ 4 | ≥ 75% surveys indicating objectionable substance(s) | Total # Action Criteria Exceeded |
|---|---|---|---|---|
| **Bay Beach** | | | | **0** |
| **Communiversity Park** | | | | **0** |
| **Fox Point Boat Launch** | | | | **0** |
| **Leicht Park** | | | | **0** |
| **Metro Boat Launch** | | | | **0** |
| **Perkofski Boat Launch** | | | | **0** |
| **Porlier Pier** | | | | **0** |
| **Regatta 220** | | | | **0** |
| **Riverview Place Park** | | | | **0** |
| **Voyageur Park** | | | | **0** |
| **Weitor Wharf** | | | | **0** |
| **West Lazarre Avenue** | | | | **0** |
| **Total** | **0** | **0** | **0** | **0** |

One consideration that may have influenced overall differences in results between the two survey periods is represented in the significant range of water levels experienced during 2013-2018, with 2013 being a record low-water year for Lake Michigan with a subsequent increase of nearly 3 feet by 2018. Lower water conditions may have resulted in more overall action criteria threshold exceedances in the 2011-2012 survey period, as more of the shoreline and previously submerged river/lakebed was visible to survey respondents.

Another factor to consider is that the survey questions allowed respondents to define what “access, enjoyment, or use” meant to them, and did not ask respondents to evaluate the likelihood of participating in specific types of recreational activities both alongside and within AOC waterbodies based on site conditions (e.g. recreation near the water vs. recreation in direct bodily contact with the water). While this may have influenced survey results, evaluating the impaired beneficial use of recreating in direct bodily contact with AOC waterbodies is being evaluated through the Beach Closings BUI.

In summary, these data indicate that none of the 12 total survey stations evaluated from 2011 – 2018 requires significant site-based management action beyond what is currently being employed locally to improve aesthetic condition at recreational areas (e.g. community clean up days, installation of garbage receptacles, maintenance of invasive species, etc.). Furthermore, these data indicate that the properties listed in the BUI removal criteria are not observed at levels sufficient to consistently interfere or impair access, enjoyment, or use of AOC waterbodies.

Following the public comment period, the following methodological concerns were raised by reviewers:

1. The appropriateness of the questions used in the survey. Concerns centered on ambiguous language (e.g. “use the water”) and questions that include multiple elements for interpretation (“make the area unpleasant *or* block your ability to access *or* use the water”), which make interpretation of results difficult. Another issue raised was that the questions target the aesthetic conditions at public access sites rather than the conditions of water in which the BUI was designated.
2. The potential for observers to become habituated to degraded conditions. Even if the survey represents a random sample of observers, if those observers have been desensitized from long-term observation to degraded conditions, then any slight improvement may bias the perception of the observer.
3. Appropriateness of setting a threshold for each element at a level where it “prevent(s) you from accessing, enjoying, or using the water”. The concern was raised that preventing use of the water would require a strong enough aversion to provoke an all or none response rather than simply a diminishment of enjoyment.
4. Appropriateness of relying on averages to meet thresholds of impairment. Relying on averages would require the offending element to be frequently present at many locations and on many occasions. This concern centers on setting thresholds that make it unlikely for an AOC to be classified as not meeting the “Aesthetics” beneficial use.
5. Appropriateness of setting a threshold for observations of a single objectionable element of greater than 75%. Concerns were raised that objectionable conditions are conceivably additive. For example, dates in which water clarity is poor may not coincide with dates where shoreline garbage is present, i.e. the objectionable condition may vary from date to date resulting in an objectionable state more frequently than any single condition occurs.

Additional data analyses completed after the public comment period and responses to these concerns were generated in coordination with WDNR Analysis Services and are included in a formal Memorandum in Appendix G. A summary of those results and responses is presented below:

1. The survey was not designed to be so granular as to differentiate among uses, nor to separate impairments to access, use, and enjoyment. The inclusion of multiple elements sought to broaden the applicability to ensure relevance to all observers. Rather than constraining the question to “users” of the resource, this wording also allows for “access” and “enjoyment”. The original RAP cited total suspended solids and algae

blooms in AOC waters as prime reasons for limited recreational use and degraded aesthetic value, though additional factors included odor problems, zebra mussel shell piles along the shoreline, and limited shoreline access and public space along the Fox River. Therefore, survey locations and questions were designed to evaluate aesthetic conditions on both the shoreline and in-water areas of the AOC.

2. Additional data analyses demonstrated that while observers may become habituated to degraded conditions, this effect can be isolated by inclusion of parameters reflecting the effects of time and an observer's previous evaluation of a site. All else being equal, observations where volunteers had previously evaluated the site received slightly, but statistically significant, higher aesthetic impression ratings. However, the effect of habituation was relatively small compared to the effects of objectionable substances evaluated.
3. Additional data analyses illustrate that in many cases, there is no significant difference between the presence of an objectionable substance at levels that do not prevent access, use, or enjoyment and the absence of the substance. Analyses confirmed that the objectionable substances evaluated differ in in their relative importance to the aesthetic quality of the site, with Shoreline Garbage identified as the most important objectionable substance contributing to lower aesthetic impression scores. These results indicate that it is a reasonable approach to determine whether an aesthetic impairment exists based on a suite of objectionable substances with the capacity to prevent access, use, or enjoyment.
4. Reliance on average scores or conditions when setting thresholds of impairment is a valid concern. Averages (means, modes, or medians) are statistical measures of central tendency and minimize the weight of extreme values in decision making. Thus, if an objectionable substance is rarely present at a level that meets the threshold for impairment, but when it is, the impairment is extreme; the average score for that substance may not be high enough to identify it as a problem. That said, while thresholds of aesthetic impression based on average ratings may be less likely to be tied to episodic events, understanding the relationship between objectionable substance presence and aesthetic impression allows decision-makers to target efforts to address underlying conditions of aesthetic impairment.
5. Additional data analyses demonstrate the nonlinear effect of multiple objectionable substances and confirm that the effects of two or more objectionable substances at levels preventing access, use, or enjoyment were much greater than the sum of their individual effects. The impact of a new objectionable substance is less if there are already several substances observed at the site. Conversely, if there are few objectionable substances observed at the site, the impact of a new substances is greater.

Several organizations contributed greatly to this assessment by providing feedback on survey methodology, volunteer coordination oversight, and community engagement throughout the survey period. WDNR recognizes the Clean Bay Backers, UW Madison Division of Extension, UW Fox Valley, and the Fox-Wolf Watershed Alliance for all the hard work and effort of those who contributed to making this project a reality.

# Ongoing Efforts and Continued Needs for Improving Aesthetic Value of the Lower Fox River and bay of Green Bay

While great strides have been taken to improve the aesthetic value of the AOC through various voluntary and regulatory initiatives, more work is needed.

Much of the impetus to reduce nonpoint source nutrient and sediment loading in the AOC is to reduce the proliferation of excessive algae, namely cyanobacterial harmful algal blooms (CHABs). Toxins produced by CHABs can have negative health effects on animals and humans most frequently through ingestion of drinking water, though additional exposure can occur through ingestion of cyanotoxin contaminated food and inhalation and dermal contact through recreational activities (Carmichael, 2001). The overall toxicity of CHABs is highly variable spatially and temporally (Nabout et al., 2013), making the mitigation of recreational risk difficult for public health entities. Several efforts are underway by many partners in the expansive Upper Fox/Wolf and Lower Fox watersheds to reduce nonpoint and point source pollution loading to Lake Winnebago and Green Bay.

As described previously, the Lower Fox River basin TMDL was approved in 2012 with implementation in progress for this 640 square mile area. The TMDL study identified a total of 549,703 lbs of phosphorus loading from in-basin sources, with 60% reduction in phosphorus loading necessary to achieve water quality goals. While reductions in point source loading have been underway for several decades, the current pace and scale of implementation to reduce nonpoint source loading began in 2015 through the development of 9 Key Element Plans, which assess contributing causes and sources of nonpoint source pollution and prioritize restoration and protection strategies to address these problems. Development of these plans is prioritized from the highest to lowest loading subwatersheds in the Lower Fox River basin, with each subwatershed at various stages of the process to both establish a plan and work toward implementation. Furthermore, development of the Lower Fox River Water Quality Management Plan began in 2020 and is an effort to align as broad a coalition of stakeholders and partners as possible to achieve water quality goals in the basin. This effort is working to establish an implementation plan with time-stamped goals and funding/policy needs to achieve those goals, shared metrics and a clean water “brand” that reflect the diverse community interests in the basin and establish a sustainable governance structure that spans multiple jurisdictions to achieve TMDL water quality goals by 2040.

Additionally, an Upper Fox and Wolf River basin TMDL was approved in 2020 with an implementation plan in progress for this 5,900 square mile area (~10% of the area of Wisconsin). These two basins converge within a series of pool lakes in Winnebago County and contain all the surface water drainage into Lake Winnebago which accounts for an additional 716,954 lbs of phosphorus loading to the lower Fox River and bay of Green Bay. In addition to the development of various lake management and 9 Key Element Plans in the Upper Fox and Wolf River basins, the Winnebago Waterways Program outlines several goals to reduce phosphorus loading and improve water quality in Lake Winnebago and serves as a guide for partners in the region to focus coordinated efforts toward recovery of the pool lakes. Progress toward water quality goals will continue to require significant regional effort to address phosphorus and sediment loading throughout the Lower Fox River basin, Upper Fox and Wolf River basins, and Upper Green Bay basins by many partners throughout the state.

Furthermore, implementation of several management actions to remove the “Loss of Fish and Wildlife Habitat” and “Degradation of Fish and Wildlife Populations” BUIs is in progress and will complement the decades of habitat restoration efforts of AOC partners and stakeholders. AOC-sponsored management actions are anticipated to be complete by 2030, though habitat restoration efforts will be pursued in perpetuity to continue improving this globally important freshwater estuary.

Finally, several exotic invasive species reduce aesthetic value within the waters of the AOC and adjacent shorelines. Zebra mussel shells often pile on shorelines, and invasive vegetation such as Phragmites can impede visibility and access to AOC waterbodies. These invasive species represent a lakewide issue that cannot be overcome by actions within the AOC-boundaries alone and will require continued regional efforts and management to realize improvements.

# BUI Removal Process and Stakeholder Engagement

A target revision and subsequent removal recommendation was discussed with the Lower Green Bay & Fox River AOC stakeholder group at the public 2018 and 2019 RAP Update meetings held on 2/11/2019 and 5/7/2020, respectively. During the 2019 virtual RAP Update meeting, participants were polled on a recommendation to revise the BUI removal target. Polling results indicated that 50% of participants supported the recommended target revision, 13% of participants indicated that there were other considerations that they would like to see made before moving forward with the recommended target revision, and 38% of participants indicated neutrality on the recommendation. One comment following the RAP Update meeting was received that included a recommendation for evaluating other considerations before moving forward with the BUI removal target revision and can be found in Appendix G.

From November 18 to December 18, 2020, a public review and comment opportunity period was held for the proposed target revision. During this publicly noticed review period, two comments were received for the target revision and can be found in Appendix G. The target revision was formally adopted on January 1, 2021.

From May 3 to June 4, 2021, a public comment and review period was held for the BUI removal recommendation. All comments and responses can be found in Appendix G.

# Conclusion

As set forth in Annex 2 of the 1987 and Annex 1 of the 2012 Amendments of the GLWQA, the BUI addressed in this document is the “Degradation of Aesthetics”. This removal recommendation outlines the rationale for listing the BUI as confirmed, actions taken that have resulted in improved aesthetic value of AOC waterbodies, and the results of a direct assessment of this BUI by the WDNR on behalf of the AOC program.

In conclusion, the Degradation of Aesthetics BUI is determined to have met the criteria for removal as supported by data collected at recreational survey stations that were evaluated from 2011 – 2018 in the AOC. These data indicated that none of the 12 total survey stations require significant site-based management beyond what is currently employed locally. Furthermore, the survey data indicates that properties listed in the BUI removal criteria are not observed at levels sufficient to consistently interfere or impair access, enjoyment, or use of AOC waterbodies and

shorelines.  Finally, several key actions identified in the original RAP as impacting aesthetic value of AOC waterbodies and shorelines have either been realized or significant progress has been made toward these key actions through other regulatory and nonregulatory mechanisms.

## Removal Statement

The WDNR Office of Great Waters recommends the removal of the Degradation of Aesthetics BUI from the Lower Green Bay & Fox River Area of Concern. This decision is based upon review of efforts to improve the aesthetic value of the AOC shoreline and waterbodies, a review of the Lower Green Bay & Fox River Volunteer Aesthetics Monitoring Program survey data and input from the WDNR, USEPA, and local stakeholders.

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# Appendices

Appendix A. List of Acronyms

Appendix B. List of Definitions

Appendix C. List of Federal and State/Local Policies, Rules, and Initiatives That Have Improved the Aesthetic Value of AOC Waterbodies

Appendix D. 2011 – 2013 Volunteer Aesthetic Monitoring Program Data Sheet and Scoring Key

Appendix E. 2011 – 2013 Volunteer Aesthetic Monitoring Program Final Report

Appendix F. 2015 – 2018 Volunteer Aesthetic Monitoring Program Data Sheet and Scoring Key

Appendix G. Comments Receiving During Public Comment Periods and Relevant Responses

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## Appendix A. List of Acronyms

| | |
|---|---|
| AOC | Area of Concern |
| BUI | Beneficial Use Impairment |
| BOD | Biological Oxygen Demand |
| CHABs | Cyanobacterial Harmful Algal Blooms |
| GLRI | Great Lakes Restoration Initiative |
| GLWQA | Great Lakes Water Quality Agreement |
| IJC | International Joint Commission |
| LAMP | Lakewide Action Management Plan |
| MS4 | Municipal Separate Storm Sewer System |
| NPS | Nonpoint Source Program |
| NRDA | Natural Resource Damage Assessment |
| OGW | Office of Great Waters |
| OU | Operable Unit |
| PCB | Polychlorinated Biphenyls |
| QAPP | Quality Assurance Project Plan |
| RAP | Remedial Action Plan |
| ROD | Record of Decision |
| SWIMS | Surface Water Integrated Monitoring System |
| TID | Tax Increment District |
| TIF | Tax Increment Finance |
| TMDL | Total Maximum Daily Load |
| USEPA | United States Environmental Protection Agency |
| UW | University of Wisconsin |
| WDNR | Wisconsin Department of Natural Resources |
| WPDES | Wisconsin Pollutant Discharge Elimination System |

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## Appendix B. List of Definitions

### Area of Concern

A region where legacy pollution— from industrial, agricultural, and urban sources— severely interferes with the public's use of water resources for activities such as swimming and fishing. Defined by Annex 2 of the 1987 Protocol to the US-Canada Great Lakes Water Quality Agreement as "geographic areas that fail to meet the general or specific objectives of the Agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." These areas are the "most contaminated" areas of the Great Lakes, and the goal of the AOC program is to bring these areas to a point at which they are not environmentally degraded more than other comparable areas of the Great Lakes. When that point has been reached, the AOC can be removed from the list of AOCs in the Annex, or "delisted."

### Beneficial Use Impairment (BUI)

A "beneficial use" is any way that a water body can improve the quality of life for humans or for fish and wildlife (for example, providing fish that are safe to eat). If the beneficial use is unavailable due to environmental problems (for example if it is unsafe to eat the fish because of contamination) then that use is impaired. The International Joint Commission provided a list of 14 possible beneficial use impairments in the 1987 Great Lakes Water Quality Agreement amendment.

### Removal Target

Specific goals and objectives established for beneficial use impairments, with measurable indicators to track progress and determine when delisting can occur.

### Remedial Action Plan (RAP)

According to the 1987 Protocol to the US-Canada Great Lakes Water Quality Agreement, a RAP is a document that provides "a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses in Areas of Concern…" RAPs are required to be submitted to the International Joint Commission at three stages: Stage 1: Problem definition Stage 2: When remedial and regulatory measures are selected Stage 3: When monitoring indicates that identified beneficial uses have been restored. Note that a renegotiated Great Lakes Water Quality Agreement was signed in 2012 by the US and Canada which removed the "stage" terminology from the AOC Annex, and simply requires Remedial Action Plans to be "developed, periodically updated, and implemented for each AOC."

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## Appendix C. Federal and State/Local Policies, Rules, and Initiatives That Have Improved the Aesthetic Value of AOC Waterbodies

1. Federal Policies, Rules and Initiatives
    a. Clean Water Act, amendments, and guidelines (Kraft, 2015 and USEPA, 2020)
        i. 1972 Amendments
            1. Established the basic structure for regulation pollutant discharges into the waters of the United States.
            2. Gave USEPA the authority to implement pollution control programs (e.g. NPDES Permit Program).
            3. Maintained existing requirements to set water quality standards for all contaminants in surface waters.
            4. Made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions.
        ii. 1977 Amendments
            1. Extended authority to include conventional, non-conventional, and toxic pollutants.
            2. Bolstered authority to eliminate toxic pollutants.
        iii. 1987 Amendments
            1. Authorized the implementation of a state revolving loan program to help local governments build wastewater treatment facilities.
        iv. 1998 “Cluster Rule” revised Effluent Guidelines and Standards for Pulp, Paper and Paperboard category (40 CFR Part 430)
            1. Established effluent limits for toxic pollutants.
            2. Published a Technical Support Document for Best Management Practices that reduce release of toxic, conventional, and nonconventional pollutants to surface water.
        v. 1992 Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDL)
            1. States identify waters that are impaired or in danger of becoming impaired and calculate and allocate pollutant reduction levels necessary to meet approved water quality standards
            2. 2013 Revised Guidelines for States’ Implementation of Nonpoint Source Management Programs under Section 319
                a. Specifies that watershed-based plans must be consistent with the Minimum Elements of a Watershed-Based Plan, commonly referred to as the “nine key elements”
    b. GLWQA, amendments, and guidelines (IJC, 2020)
        i. 1972 GLWQA established with focus on reduction of phosphorus entering Great Lakes from industries and communities
            1. Establishes shared goals and objectives for improving water quality in the Great Lakes
            2. Provides a joint framework for restoration, protection, and management of the Great Lakes between the US and Canada
        ii. 1978 Amendment
            1. Broadens approach to reduction of toxic substances using an ecosystem approach
        iii. 1987 Protocol to the 1978 GLWQA

1. Establishes 43 discrete geographic locations (e.g. AOCs) to prioritize remedial efforts within the Great Lakes in the most polluted locations in the watershed
2. Creates a framework for developing lakewide management plans to eliminate pollution

iv. 1991 List/Delist BUI Criteria
1. Establishes general listing and delisting guidelines for 14 BUIs to serve as an initial reference point for defining and addressing specific issues in AOCs.

v. 2012 Amendment
1. Expands commitment of both countries to address issues in nine goal areas and ten annexes that will restore and maintain the chemical, physical, and biotic integrity of the Great Lakes system.

2. State and Local Policies, Rules and Initiatives (WDNR, 2015)
   a. Chapter NR 120, Wis. Adm. Code
      a. Between 1979 and 2009, WDNR developed watershed-based nonpoint source control plans under PWS, which provided financial assistance to local units of government in selected watersheds to address land management activities contributing to urban and rural runoff. The process to develop priority watershed plans were similar to those currently used to develop TMDLs and TMDL implementation plans. (WDNR 2015). In 2012, the USEPA approved the TMDL report for the Lower Fox River from the Lake Winnebago outlet through the lower part of Green Bay which set targets for total phosphorus and total suspended solids (Cadmus Group Inc 2012, SeaGrant Wisconsin 2013).
   b. NR 151, Wis. Adm. Code, contains runoff pollution performance standards for Wisconsin. Steady progress has been made towards carrying out the implementation strategy put in place shortly after it went into effect in October 2002 (WDNR 2015).
   c. NR152: Model Ordinances for Construction Site Erosion Control and Storm Water
   a. NR153: Targeted Management Grant Program: addresses funding of urban portions of priority watershed and lake projects and a newer grant program.
   b. NR154: Best Management Practices, Technical Standards, and Cost-Share Conditions for projects outlined in NR 120, NR 153, and NR 243.
   c. NR155: Urban Nonpoint Source and Storm Water Management Program: details the procedures and criteria for a new grant program.
   d. NR216: Storm Water Discharge Permits: requires municipalities, industries, and construction sites to follow the non-agricultural performance standards as part of their storm water permits.
   e. NR243: Animal Feeding Operations: adds the NR 151 performance standards and prohibitions to the Manure Management Program.
   f. USEPA delegated to Wisconsin the authority to regulate storm water discharges, which are covered by Chapter 216 of the Wis. Adm. Code, the Wisconsin Storm Water Management Permit Program. Municipalities in the AOC are required to obtain a municipal storm water discharge permit and certain facilities are required to obtain industrial permits (WDNR 2001).
   g. By 1987, various industries and municipalities along the lower Fox River invested approximately $300 million in technological pollution controls under the Clean

Water Act (Mazmanian & Kraft, 2009) that have resulted in significantly less point and nonpoint source pollution in the AOC.

h. Lower Green Bay & Fox River AOC RAP and RAP Update established in 1988 and 1993, respectively. Stage 2 RAP Update prepared in 2011.
i. WDNR staff and the Lower Fox River basin Partner Team met in 2000 to develop lists of issues, threats, and opportunities for the basin, culminating in the creating of the Lower Fox River Integrated Management Plan. Issues with nutrient and solids loading, stormwater discharges, runoff and erosion were major concerns along with toxic pollution remediation and groundwater protection (WDNR 2001).
j. In 2016 the Great Lakes Commission announced the first US water quality trade, the Fox P Trade program, designed to alleviate high nutrient levels and algal blooms in the Lower Fox River Watershed by establishing a water quality trading market. The project was developed from 2013-2016 in partnership with the Fox-Wolf Watershed Alliance, US Department of Agriculture Natural Resources Conservation Service, and WDNR. Under the agreement NEW Water would compensate Bob Van De Loo and Sons for use of cover crops, conservation tillage, and buffers to reduce phosphorus runoff from their farm (Great Lakes Commission 2016).
k. A State and USEPA approved TMDL was established in 2012 for the Lower Fox River basin, and TMDL implementation is ongoing. To date, State- and USEPA-approved 9 Key Element watershed plans for Plum and Kankapot, Upper East, Lower East, Bower, Apple, Upper Duck, and Lower Fox River Mainstem and Garners Creek have been completed. Furthermore, the Lower Fox River basin TMDL Implementation and Lower Fox River Water Quality planning initiatives are in progress.

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## Appendix D. 2011 – 2013 Volunteer Aesthetic Monitoring Program Data Sheet and Scoring Key

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**Green Bay Volunteer Aesthetics Monitoring**

# MONITORING DATA SHEET

**Station Name/Location:** _____

**Demographic information (optional):**

**Sex: (please circle)** **M** **F** **Age:** _____

**How many years have you lived in the county?** _____

**Approximately how many times have you previously vistited this location in the past 10 years?** _____

| **Describe conditions at site during this particular visit** | | | | |
|---|---|---|---|---|
| 1. Monitoring Date: (include year) | | | | |
| 2. Start Time: | | | | |
| 3. Data Collector: | | | | |
| 4. Describe water conditions: | Flat/Calm | Slight Movement | Moderate Flow/waves | Rough/Fast Flowing |
| 5. Water Level: | Don't Know | High | Low | Normal |
| 6. Did you take any pictures? Please describe.<br><br>please email pictures with location and date information to Laurel.Last@wisconsin.gov | | | | |
| **Overall aesthetic impression of the site** | | | | |
| 7. Overall, do you find the site aesthetically pleasing? Please describe. List any factors that make it pleasing or not pleasing. | Very Pleasing (0) | Somewhat Pleasing (1) | Neutral (2) | Somewhat Displeasing (3) | Very Displeasing (4) |
| | Explain: | | | | |
| 8. Have you previously evaluated this station? Y/N | | Yes | | No | |
| 9. If you have previously evalutated this station, have you noticed any changes in aesthetic quality of the water or along the shoreline since your last visit? | | | | |
| **Materials producing color, odor, taste, or unsightliness** | | | | |
| 10. Are any materials producing color, odor, taste or unsightliness present to the extent that they make the area unpleasant or block your ability to access or use the water? | | Yes (1) | | No (0) |
| | Please describe | | | |
| 11. Water Color: | Clear (0) | Red Stained (1) | Green Stained (Pea Soup) (1) | Brown (Turbid) (1) |
| | No Smell (0) | Fishy (1) | Sulfur/Rotting Eggs (1) | Musty/Wet Soil (1) |

| | | | |
|---|---|---|---|
| 12. Odor of Water: | Algae/Decaying Plants (1) | Chlorine (1) | Other (please describe)_____ (1) |

**Substances causing objectionable deposits on shore or in bed of River/Bay**

14. Are any of the following present **on the shoreline or bottom of River/Bay** to the extent that they make the area unpleasant or block your ability to access or use the water?

| | | | | | |
|---|---|---|---|---|---|
| A. Submerged garbage - Y/N | Yes (1) | | No (0) | | |
| If yes, list visible item(s): If unidentifiable, please indicate. | | | | | |
| B. Shoreline garbage - Y/N | Yes (1) | | No (0) | | |
| If yes, circle type(s): | Street Litter | Food-related Litter | Medical Items | Resin | Sewage-related Litter |
| | Building Materials | Fishing-related Litter | | Household Waste | Other (please describe)_____ |
| C. Animals (geese, gulls, etc) - Y/N | Yes (1) | | No (0) | | |
| If yes, list type(s) and reason for problem (droppings, aggressive, etc): | | | | | |
| D. Dead animals - Y/N | Yes (1) | | No (0) | | |
| If yes, list type and amount: | | | | | |
| E. Invasive species (Phragmites, zebra/quagga mussels, other) - Y/N | Yes (1) | | No (0) | | |
| If yes, list type(s): | | | | | |
| F. Other - Y/N | Yes (1) | | No (0) | | |
| | Please describe | | | | |

15. Please indicate if any of the following are present **in the water** to the extent that they make the area unpleasant or block your ability to access or use the water:

| | | | | | |
|---|---|---|---|---|---|
| A. Floating Garbage - Y/N | Yes (1) | | No (0) | | |
| If yes, estimated percent of floating garbage on water surface: (see attached directions for estimation) | | | | | % |
| If yes, please list circle type(s): | Street Litter | Food-related Litter | Medical Items | Resin | Sewage-related Litter |
| | Building Materials | Fishing-related Litter | | Household waste | Other (please describe)_____ |
| B. Surface Water Description: | Normal | Oily Sheen | | Neon Green Sheen | Foamy |
| | Floating Aquatic Plants | | Natural Debris | Other (please describe)_____ | |
| C. Algae - Y/N | Yes (1) | | No (0) | | |
| If yes, estimated percent of algae on water surface: (see attached directions for estimation) | | | | | % |
| If yes, please circle type(s): | Blobs of Floating Material | | | Green Soupy | Matted |
| | Attached to Rocks/Stringy | | | Other (please describe)_____ | |
| If yes, please circle color: | Light Green | | Blue Green | | Dark Green |
| | Brown | Red | Yellow | Other (please describe)_____ | |
| D. Other - Y/N | Yes (1) | | No (0) | | |
| | Please describe | | | | |

| | |
|---|---|
| **Survey END** | |
| 16. While filling out this survey, please describe the most difficult task (if any) | |
| 17. Comments:<br>Please include anything else you though should be reported while completing out this survey. (Please use back for additional comments) | |
| 18. End Time: | |
| **19. Date the data were entered in SWIMS: (for DNR use only)** | |
| **QA/QC: (for DNR use only)** | |

**Please return this survey to:**
**Laurel Last**
**Department of Natural Resources**
**2984 Shawano Avenue**
**Green Bay WI 54313-6727**

**Contact Laurel Last (Laurel.Last@wisconsin.gov) or Christina Anderson (Christina.anderson@wisconsin.gov) with any questions regarding this survey.**

**Aesthetics Monitoring Methods**

**Contact Christina Anderson with any questions – christina.anderson@wisconsin.gov**

****Please evaluate water and immediate shoreline. Refrain from including anything on land in your assessment.**

Question by question instruction to Green Bay Aesthetics Monitoring (Follow along with datasheet)

***Header***

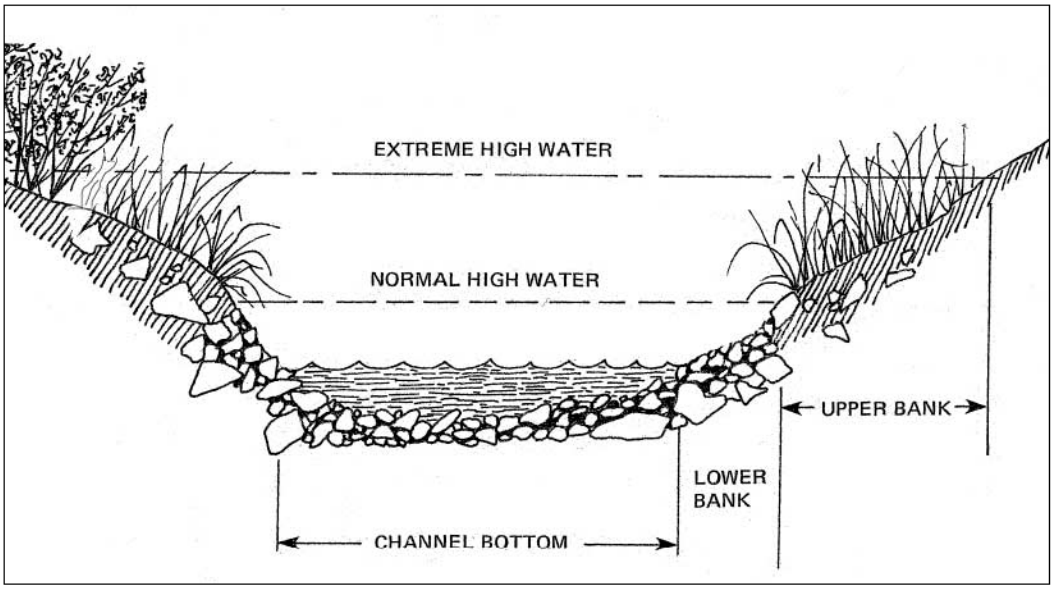
**Station ID**- You will obtain an ID from the coordinator that geospatially links your data to your station in the DNR database, Surface Water Integrated Monitoring Systems (SWIMS).

**Station Name/Location**- If you have been provided a station name, please record here. If not, please describe your location.

**SWIMS Data Entered By**- If you will be entering data into the DNR database, please identify one person in your team that will enter for the group. Try to enter data after each monthly field visit.

***Describe conditions at site during this particular visit***

1. **Monitoring Date**- The date of the field event.
2. **Start Time**- The time you arrived at the station.
3. **Data Collector**- The name or initials of the team member filling out the datasheet.
   **NOTE: Because of the subjectivity of most of the questions, we ask that only one person fill out the datasheet. If there are multiple people present during field event, please fill out separate datasheets.**
4. **Describe water conditions**- Please choose from the following: Flat/Calm, Slight Movement, Moderate Flow/Waves, Rough/Fast Flowing
5. **Water Level**- Please record the water level of the area. Choose from the following: Don't Know, High, Low, Normal.
   <u>How to describe water level:</u> This is something that you will feel more comfortable with assessing the more you visit your stream site. Some things to look for when you first visit your site to help you make the assessment are:
   - Look to see if terrestrial vegetation along banks is submerged. The terrestrial vegetation will end at the normal high water mark.
   - Look for water stains on rocks or bridge abutments. Water will stain rocks if it flows over or by them for an extended period of time. If you see stains above the level of water in the stream during you visit, the level is likely low.




*This diagram shows a cross section of a typical streambank, demarcating the upper and lower banks.*

6. **Did You Take Any Pictures? Please Describe**- Number your pictures in order and describe what you are photographing. Example: Photo 1 on 7/15/11, From east shoreline looking upstream. Photo 2 on 7/15/11, garbage on the beach is aesthetically displeasing. Take pictures to show why you think the station is pleasing or displeasing. Feel free to submit as many pictures as you would like.

***Overall aesthetic impression of the site***

7. **Overall, Do You Find the Station Aesthetically Pleasing? Please Describe Why**- Please choose from the following: Very Pleasing, Somewhat Pleasing, Don't Know, Somewhat Displeasing, Very Displeasing. Please follow up your response with an explanation.
8. **Have You Previously Evaluated This Station? -**Y/N
9. **If you have previously evaluated this station, have you noticed any changes in aesthetic quality of the water or along the shoreline since your last visit?** - Describe any changes in the space provided on the datasheet.

***Materials producing color, odor, or unsightliness***

10. **Are any materials producing color, odor or unsightliness present to the extent that they make the area unpleasant or block your ability to access or use the water? Y/N Please describe.** – Look around your station and describe in the provided space if there is anything that fits the description above.
11. **Water Color** - Describe the color of the water from where you are standing. Please choose from the following: Clear, Red Stained, Green Stained (Pea Soup), Brown (Turbid). Please leave this section blank if you are colorblind.
12. **Odor of Water** - Please describe the smell, if any, coming from the water. It may be useful to fill the transparency tube for question 12 to get a more accurate description of odor. Be sure not to describe odors from other areas, such as, a nearby garbage can or the city. Choose from the following: No Smell, Fishy, Sulfur/Rotting Eggs, Algae/Decaying Plants, Musty/Wet Soil, Chlorine, Other (Please Describe).
13. **Transparency Tube** - <u>How to measure transparency:</u> Collect the sample away from the bay or stream bank in the main flow (well-mixed) area. Be careful not to disturb the bottom when you collect the water sample. If you get sediment from bottom disturbances, dump out the sample, move upstream away from the disturbed area and try again or filter through the provided nylon. For the observer, consistency is the key. If you initially wear your eyeglasses when you take the reading, then always wear your eyeglasses to take this measurement. Never wear sunglasses when you take this reading. To collect a sample while standing on the shore, use a bucket or sample bottle attached to a pole so that you can reach off-shore. Scoop from below the surface in the upstream direction. Be careful not to stir up the sediment upstream of your sample.

    **Reading the Transparency Tube**

    1. Remove large objects from the water sample. (Filter through nylon stocking if necessary.)
    2. If the sample has settled, use a stirring stick to stir the sample, or pour the sample into a clean bucket and back into the transparency tube to suspend all materials.
    3. Stand out of direct sunlight. If you cannot get to a shady place, use your body to cast a shadow on the tube (Figure 1).
    4. If you are wearing sunglasses, remove them. Then look for the target (black and white) disc on the bottom of tube. If disc is visible, record the length of the tube (e.g., 120 cm) on the data sheet.
    5. If target disc is not visible, have your partner let water out a little at a time using the valve at the bottom until disc is just visible (Figure 2). Have them stop letting water out immediately when you can just see the contrast between black and white on the disc.
    6. Read the level of water in the tube in cm using the measuring tape on the side of the tube.
    7. Record the measurement on your data sheet in cm.
    8. Dump contents of tube on ground.

9. Collect a new sample then repeat steps 1 through 8.
10. Record the second measurement in cm on your data sheet.

Figure 1: Transparency tube shaded by observer.

Figure 2: Slowly releasing water until the disk is just visible.

***Substances causing objectionable deposits on shore or in bed of River/Bay***

14. **Are any of the following present on the shoreline or bottom of River/Bay to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water? –** Please answer for the following categories:
    A. **Submerged Garbage** – Y/N
        **If Yes, list visible item(s)** – If you are able to see what the submerged item is, please identify. If you are unable to identify item, do your best to describe. It's our hope that with this information, we would be able to help get these large items removed.
    B. **Shoreline Garbage** – Y/N
        **If Yes, circle type(s) --** Use the chart below and circle the Type of garbage present. You can select more than one. If you circle 'Other', please describe.

| **Type** | **Street litter** | **Food-related litter** | **Medical items** | **Resin** | **Sewage-related** | **Building materials** | **Fishing related** | **Household waste** | **Other** |
|---|---|---|---|---|---|---|---|---|---|
| **Example** | Cigarette filters | Food packing, beverage containers | Syringes | Tiny plastic pellets | Condoms, tampons | Pieces of wood, siding | Fishing line, nets, lures | Household trash, plastic bags | Anything else present not represented here |

    C. **Animals (geese, gulls, dogs, etc)** – Y/N
        **If Yes, list type(s) and reason for problem (droppings, aggressive, etc)**
    D. **Dead Animals** – Y/N
        **If Yes, list type(s) and amount –** Please record amount using a whole number. Avoid using ranges (12 instead of 10-15).

E. **Invasive Species (Phragmites, zebra/quagga mussels, other)** – Y/N
   **If Yes, list type(s) and amount** – If you are able to identify invasive species located at the station, please record the species and amount.
F. **Other** – Y/N Is there anything else that does not fit in the categories above that is present along the shoreline or bottom of River/Bay to the extent that they make the area unpleasant or block your ability to enjoy the water? If so, please describe in the space provided.

15. **Please indicate if any of the following are present in the water to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water –** Please answer for the following categories:
    A. **Floating Garbage** – Y/N
       **If Yes, estimate percent of floating garbage on water surface** - Please estimate the percent of garbage floating on the surface of the water, if any. Use the attached figure to help you estimate percentages. Please use an exact number rather than a range.
       **If Yes, please circle type(s)** – Use the chart in question 13-B and circle the Type of garbage present. You can select more than one. If you circle 'Other', please describe.
    B. **Surface Water Description –** Describe the condition of the surface of the water body. Please choose from the following: Normal, Oily Sheen, Neon Green Sheen, Foamy, Floating Aquatic Plants, Natural Debris (Example: sticks, leaves), Other (please describe).
    C. **Algae** – Y/N
       **If Yes, estimate percent of algae on water surface -** Please estimate the percent of algae present (if any) using the attached figure. Please use an exact number rather than a range.
       **If Yes, circle type(s)** – Please describe the type of algae present, if any. Choose from the following: Blobs of Floating Material, Green Soupy, Attached to Rocks/Stringy, Matted, Other (please describe). You may record more than one type of algae if present.
       **If Yes, circle color –** Please record the color of algae present, if any. Choose from the following: Light Green, Blue Green, Dark Green, Brown, Red, Yellow, Other (please describe). You may record more than one color of algae if present. Please leave this section blank if you are colorblind.
    D. **Other** – Y/N Is there anything else that does not fit in the categories above that is present in the water to the extent that they make the area unpleasant or block your ability to access the water? If so, please describe in the space provided.

***Survey End***

16. **While filling out this survey, please describe the most difficult task (if any**) – Did you find a particular question difficult to answer or task difficult to complete? Please record that here.
17. **Comments** – Record any additional comments in the space provided. Consider things that you thought should be reported but where not asked.
18. **End Time –** Please record the time the field was completed.
19. **Date the data were entered in SWIMS –** Please record the date you entered your data into SWIMS.

## Appendix E. 2011 – 2013 Volunteer Aesthetic Monitoring Program Final Report

# Lower Green Bay and Fox River AOC Aesthetics Citizen Monitoring Report

**Adam Nickel and Laurel Last, WDNR**

**February 2014**

## INTRODUCTION

The Degraded Aesthetics beneficial use impairment (BUI) delisting targets for the Lower Green Bay and Fox River Area of Concern (AOC) reference monitoring data and/or surveys within the AOC for any five year period (WDNR, 2009). NEW Water's (Green Bay Metropolitan Sewerage District's) ambient monitoring program collects water quality data at several stations in the AOC. Because the aesthetic parameters, including "floating or submerged debris, oil, scum" and "materials producing color, odor, taste, or unsightliness," detailed in the delisting target are subjective in nature and involve personal interpretation of what is an "unacceptable level" or an "objectionable" amount that would interfere with public rights or impair use, a program to assess public perception was needed.

The Lower Green Bay and Fox River AOC Aesthetics Citizen Monitoring Program was developed to involve local residents in the process for evaluating the Degraded Aesthetics BUI. This approach provided opportunities to expand public participation, collect data at minimal cost, incorporate public input when evaluating BUI status, provide guidance for delisting BUI targets, and identify management options. A pilot monitoring program was launched with local residents in fall of 2011. This program was then expanded in 2012 and 2013 to include more volunteers, more sites, and a longer monitoring season. Public access points throughout the AOC were selected as monitoring sites (see Figure 1). The 11 sites include 8 sites along the Fox River, 2 sites in the Bay of Green Bay, and 1 site at Duck Creek. The Duck Creek (Wietor Wharf) site was added in 2013 to replace the Lineville Road site due to access issues. The survey developed for this program was three pages long, and included a combination of objective and subjective questions. See Appendix A for the 2012 and 2013 survey forms.

In 2013, a UW-Green Bay student was hired to conduct short surveys of citizens using the same sites that were evaluated by the dedicated volunteers. The survey (see Appendix C) was only five questions long, and included some of the same questions on the long survey form, including the question regarding their overall aesthetic impression of the site. The purpose of the survey was to gather opinions from the broader public in order to provide additional input on the status of the impairment from the people who were actually using the resource.

The objective of this report is to provide a summary of the aesthetics monitoring survey results for each site evaluated. Based on the results, recommendations will be made regarding the status of the Degraded Aesthetics BUI, management options will be identified for site improvement if action is required, and suggestions will be made for improving the citizen monitoring program.

## METHODS

### Volunteer Monitoring

All citizen monitoring volunteers were required to attend a training event prior to conducting surveys. During the training, coordinators explained the survey and how to correctly fill out the citizen monitoring data sheet (Appendix A), but care was taken not to bias surveyor opinions. Participants were supplied with an equipment kit including the following: bucket pole sampler, transparency tube, nylon for filtering debris, digital camera, a clipboard, and a backpack. For the 2013 monitoring season, taking transparency was optional. Participants followed sampling protocol according to the Aesthetics Monitoring Methods (Appendix B), though transparency tube reading and garbage type methodology was adapted from the Water Action Volunteer Stream Monitoring and Adopt-a-Beach Program. Following the 2012 survey year, adjustments were made to the monitoring data sheets to make them more user friendly and additional questions were added to bolster the survey.

For the 2012 and 2013 seasons, volunteers were asked to sign up for at least 3 monitoring sites, and to survey each during at least 2 seasons. For this project, seasons were divided into spring (April and May), summer (June, July, and August), and fall (September,

October, and November). The goal was to have at least 3 volunteers signed up for each site. Volunteers conducted the surveys on their own schedules, and returned the completed surveys (by mail, fax, e-mail, or in person) to Laurel Last, the AOC Coordinator. If they took photos, they also sent the digital photo files to Laurel. Laurel reviewed the surveys and then sent them on to the Aesthetics Data Support LTE for entry into the WDNR Surface Water Integrated Monitoring System (SWIMS) database.

**Citizen Surveys**

The student surveyor utilized a tablet computer and a mobile hotspot during data collection. Rather than collect survey data on paper and then have to transfer responses into the SWIMS database at a later time, it was decided to utilize the tablet and mobile hotspot to directly enter the responses into SWIMS as the respondent was engaged. This saved a step in the data collection process and left more time for the student to collect survey data. The student also carried paper copies of the survey form as a back-up in case of trouble with the electronic system. Since SWIMS logs off if there is no activity for 15 minutes, he found that in some circumstances it was more convenient to use the paper forms and enter the data into SWIMS at a later time. He also carried a laminated copy of the survey so the citizens could follow along as he asked them the survey questions.

The student visited the eleven survey sites on his own schedule, starting in June. He set up a rotating weekly schedule (3 or 4 sites each week) to visit all of the locations on a regular basis. Initially, he visited each one for an equal length of time, but he learned that the number of people using the sites differed quite a bit. Rather than waste his time at a site that was rarely visited, he opted to gather more surveys by waiting for about ten minutes at a site and then, if there was nobody to interview, moving on to another site. If he knew a big event was going on he made sure to go to the park nearest to the event if possible (e.g., De Pere Days in Voyageur Park, Tall Ship Festival at Metro Boat launch). After his initial visit to the Bay Beach site, he decided not to collect surveys there due to the difficulty in getting to the water. (Visitors do not currently use the shoreline because of the invasive Phragmites.)

## ANALYSIS

### Volunteer Monitoring

The volunteer monitoring program resulted in the completion of 8 surveys in 2011, 60 surveys in 2012, and 72 surveys in 2013. Numbers were lower than expected, because volunteers did not always follow through on the surveys they planned to do. The goal for each station was to have at least three volunteers visit each station during at least 2 different monitoring seasons. Seasons were divided into spring (April and May), summer (June, July, and August), and fall (September, October, and November). In order to meet this goal the 2011, 2012, and 2013 surveys were combined for each site resulting in 8 of 11 sites meeting the goal criteria. Any surveys that were incomplete and could not legitimately be completed were not included in analysis. There were 3 sites that did not meet the three volunteer requirements during at least 2 seasons; however, two were included in analysis in order to utilize all data. Analysis was not conducted for the Duck Creek Wietor Wharf site because it was added in 2013 and only 3 surveys were completed.

A ranking system was developed for each survey and questions were assigned a point value. Volunteer monitors were required to rank the overall aesthetic impression of the site as: very pleasing (rank = 0), somewhat pleasing (rank = 1), neutral (rank = 2), somewhat displeasing (rank = 3), or very displeasing (rank = 4). An assessment score was also attained for each survey that included adding the points for 10 yes or no questions where an answer of “yes” received a 1 and “no” a 0 (Appendix C). Mean overall aesthetic impression and assessment scores were calculated for each site allowing for comparisons to be made among sites (higher scores indicated a more aesthetically displeasing site). In addition, sites were also assessed individually by examining specific aesthetic parameters and calculating the percent of surveys that were chosen as aesthetically displeasing (i.e. if yes was selected for invasive species in 3 of 4 surveys the percent would be 75%). This was also conducted on a seasonal basis (spring, summer, and fall) to assess seasonal trend and identify problem areas.

In order to develop site-based management recommendations several criteria for identifying problem areas were developed. Problem sites that may require some form of remediation were identified as those meeting at least one of the following criteria:

- Mean overall aesthetic impression ranks of $\geq$ 3
- Mean assessment score of $\geq$ 5
- Sites with aesthetic parameters that are classified as aesthetically displeasing in $\geq$ 75% of total surveys

**Citizen Surveys**

Action criteria were not set for the 2013 citizen survey project. It was meant to supplement the information being gathered by the volunteer monitoring program, and to test this additional method for gathering opinions on the Degraded Aesthetics impairment. The citizen survey did include the question about overall aesthetic impression of the site (Question #2), so a mean overall aesthetic impression rank could be calculated, just as with the volunteer monitoring program data. Numerical ranks were also assigned to the answers for Questions #3 and #4 in order to visualize the results by site using histograms (not included in this report).

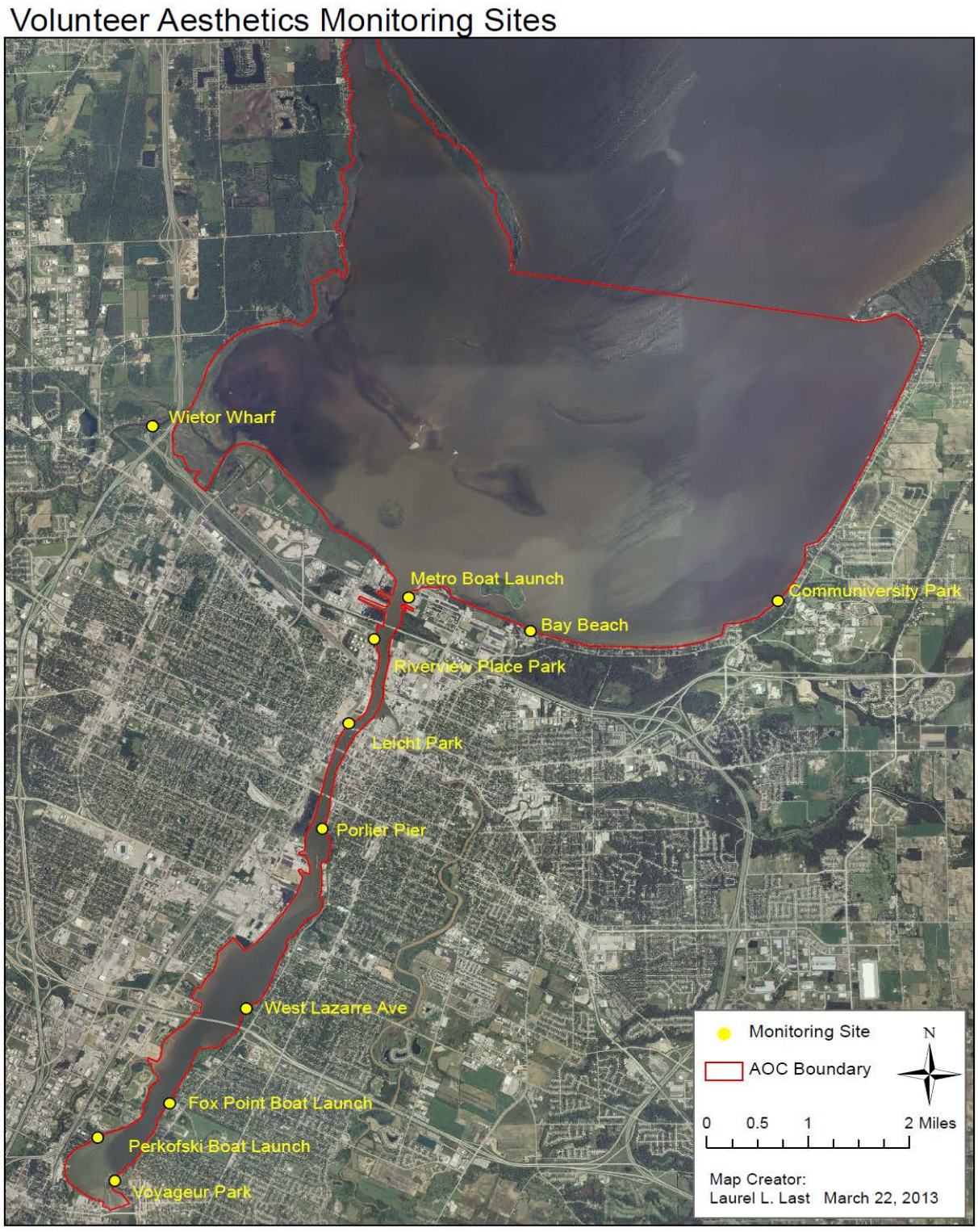



Figure 1. Monitoring site locations for the Lower Green Bay and Fox River AOC Aesthetics Citizen Monitoring Program during the 2011-2013 sampling seasons, the Wietor Wharf site was added in 2013. The AOC boundary is outlined in red.

## RESULTS

### Volunteer Monitoring

Fox River-Voyageur Park

There were a total of 20 aesthetic monitoring surveys conducted at the Fox River-Voyageur Park from 2011-2013. The mean aesthetic impression rank was 1.6, falling between somewhat pleasing and neutral. Somewhat pleasing (rank = 1) was selected on 9 surveys; however, somewhat displeasing was also chosen in 6 surveys (Figure 2). The mean assessment score at Fox River-Voyageur Park was 2.3 and 0 was the most common assessment score (6 surveys; Figure 3). In addition, there were no assessment scores greater than 6. Shoreline garbage was also selected in 40% of surveys with street and food litter noted as aesthetically displeasing (Table 1). Floating algae was selected in 35% of surveys, but a seasonal peak occurred in fall when it was selected in 50% of surveys. Conversely, submerged garbage had a seasonal peak in spring where it was selected in 60% of surveys (Table 1).

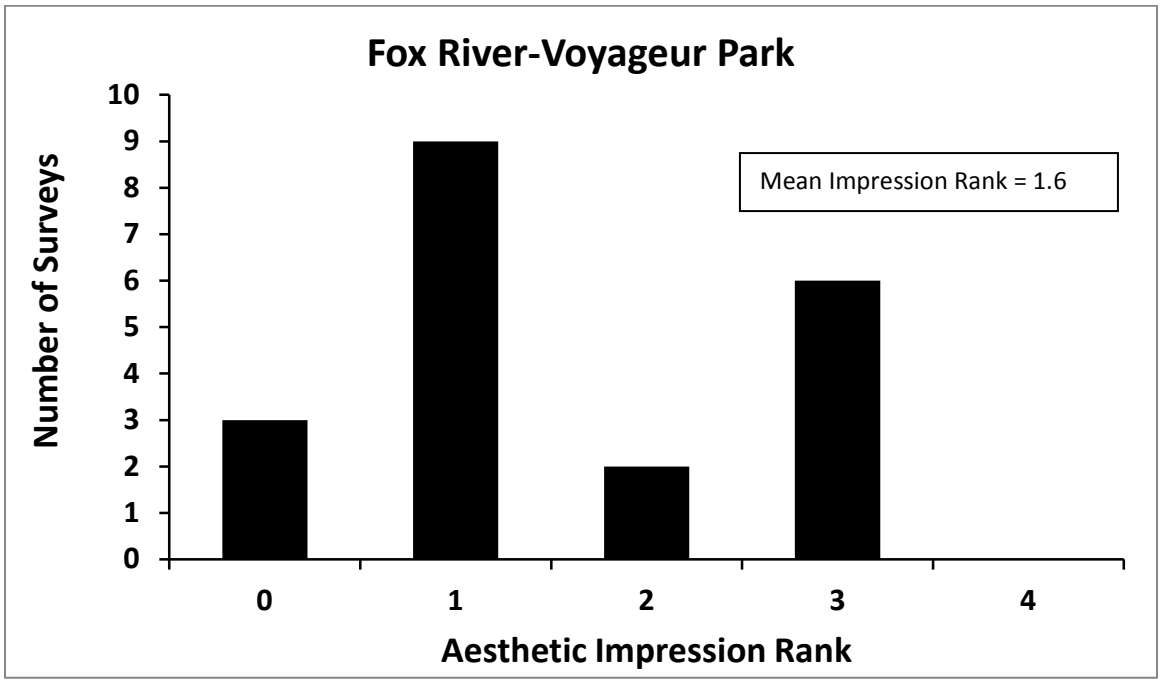



Figure 2. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Voyageur Park.

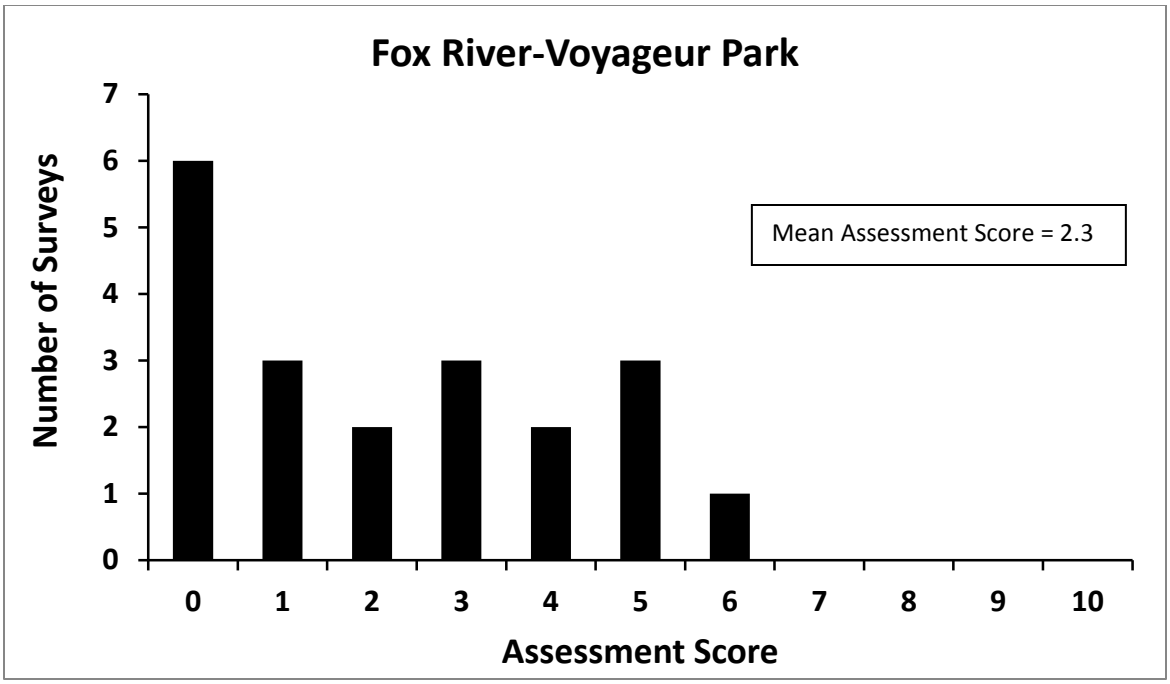



Figure 3. Assessment score and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Voyageur Park.

Table 1. Percent (%) of surveys for the Fox River-Voyageur Park that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 5) | Summer (N = 9) | Fall (N = 6) | Total (N = 20) |
|---|---|---|---|---|
| Materials (color, odor, taste, or unsightliness) | 40 | 33 | 33 | 35 |
| Submerged Garbage (on the shoreline or bottom) | 60 | 22 | 0 | 25 |
| Shoreline Garbage (on the shoreline or bottom) | 40 | 44 | 33 | 40 |
| Animals (on the shoreline or bottom) | 20 | 11 | 17 | 15 |
| Dead Animals (on the shoreline or bottom) | 0 | 11 | 0 | 5 |
| Invasive Species (on the shoreline or bottom) | 0 | 11 | 0 | 5 |
| Other things unpleasant (on the shoreline or bottom) | 0 | 0 | 33 | 10 |
| Floating Garbage (in the water) | 20 | 22 | 17 | 20 |
| Floating Algae (in the water) | 20 | 33 | 50 | 35 |
| Other Floating Material (in the water) | 40 | 11 | 17 | 20 |


Fox River-Voyageur Park, 08/29/2012, Nicole Van Helden

Fox River-Voyageur Park (submerged garbage), 05/31/2013, Julia Noordyk


Fox River-Voyageur Park Pier View (floating algae), 08/29/2013, Julia Noordyk

Fox River-Perkofski Boat Landing

From 2011-2013 there were 11 aesthetics monitoring surveys conducted at the Perkofski Boat Landing. The mean impression rank was 1.6 and somewhat pleasing (rank = 1) was selected the most (Figure 4). The mean assessment score for the Perkofski Boat Landing was 2.6 with scores ranging from 0 to 6 (Figure 5). Unpleasant materials and shoreline garbage were selected as displeasing factors in 55% of surveys; however, a seasonal peak in summer occurred with each parameter selected in 75% of surveys (Table 2). Displeasing materials selected as aesthetically displeasing included weeds and algae along the shoreline while household waste was commonly listed for shoreline garbage. Floating algae mostly classified as green soupy was noted in 50% of surveys during summer and fall. Goose droppings were also listed as making the site unpleasant in 50% of summer and fall surveys (Table 2).

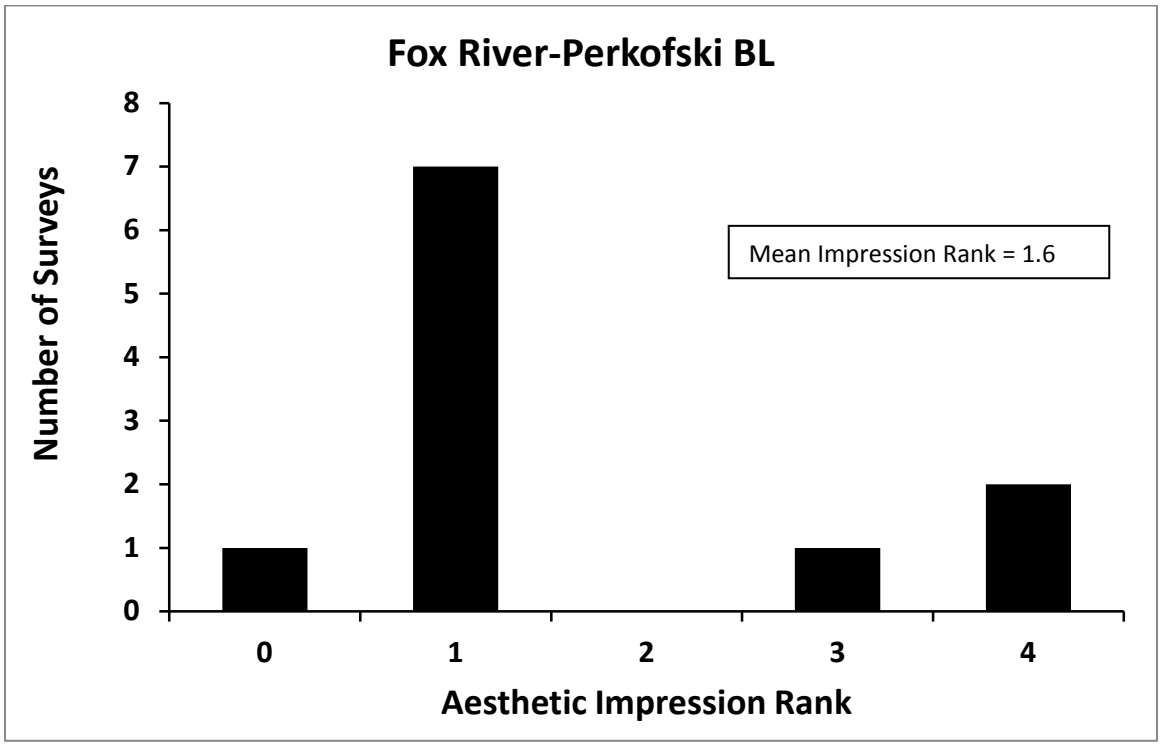



Figure 4. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Perkofski Boat Landing.

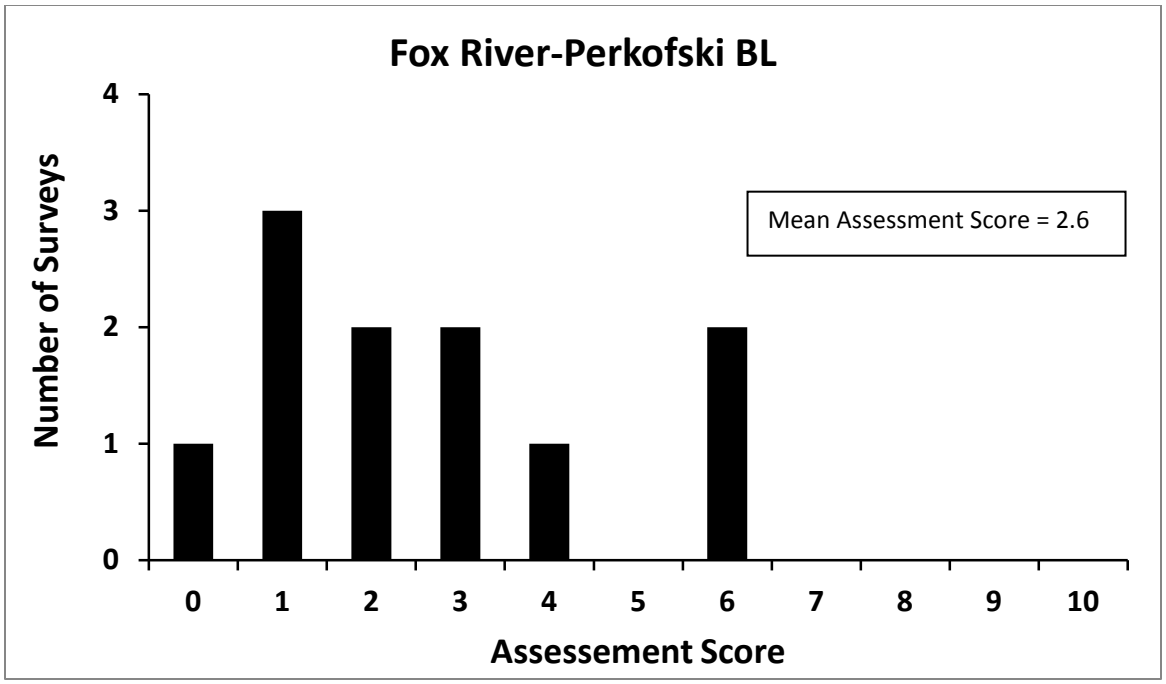



Figure 5. Assessment score and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Perkofski Boat Landing.

Table 2. Percent (%) of surveys for the Fox River-Perkofski Boat Landing that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 3) | Summer (N = 4) | Fall (N = 4) | Total (N = 11) |
|---|---|---|---|---|
| Materials (color, odor, taste, or unsightliness) | 67 | 75 | 25 | 55 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Shoreline Garbage (on the shoreline or bottom) | 67 | 75 | 25 | 55 |
| Animals (on the shoreline or bottom) | 0 | 50 | 50 | 36 |
| Dead Animals (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Invasive Species (on the shoreline or bottom) | 0 | 25 | 25 | 18 |
| Other things unpleasant (on the shoreline or bottom) | 33 | 25 | 0 | 18 |
| Floating Garbage (in the water) | 0 | 0 | 25 | 9 |
| Floating Algae (in the water) | 33 | 50 | 50 | 45 |
| Other Floating Material (in the water) | 33 | 50 | 0 | 27 |


Fox River-Perkofski Boat Landing (goose droppings on pier), 10/07/2011, Nicole Van Helden


Fox River-Perkofski Boat Landing (green soupy algae bloom), 08/29/2012, Cheryl Bougie


Fox River-Perkofski Boat Landing (attached algae), 07/25/2013, Cheryl Bougie

Fox River-Fox Point Boat Landing

From 2011-2013 a total of 20 aesthetic monitoring surveys were completed at the Fox River-Fox Point Boat Landing. The mean aesthetic impression rank was 1.4, falling between the somewhat pleasing and neutral description (Figure 6). Somewhat pleasing (rank = 1) was selected the most (10 selections) while the neutral designation (rank = 2) was only selected in one survey (Figure 6). Assessment scores for the Fox River-Fox Point Boat Landing ranged from 0 to 7 and the mean assessment score was 2.6 (Figure 7). Shoreline garbage was selected in 55% of surveys and during the summer season shoreline garbage was selected in 67% of surveys (Table 3). Food related litter, street litter, and household waste were the most commonly selected items for shoreline garbage. The materials and invasive species parameters were selected in 45% of surveys, but seasonal trends were not apparent (Table 3). Materials that were often identified included goose droppings and turbid water, while Phragmites was the dominant invasive species found. Floating algae in the form of green soupy was selected in 40% of surveys, but major differences were not observed among seasons (Table 3). No other aesthetic parameter was selected in greater than 20% of surveys (Table 3).

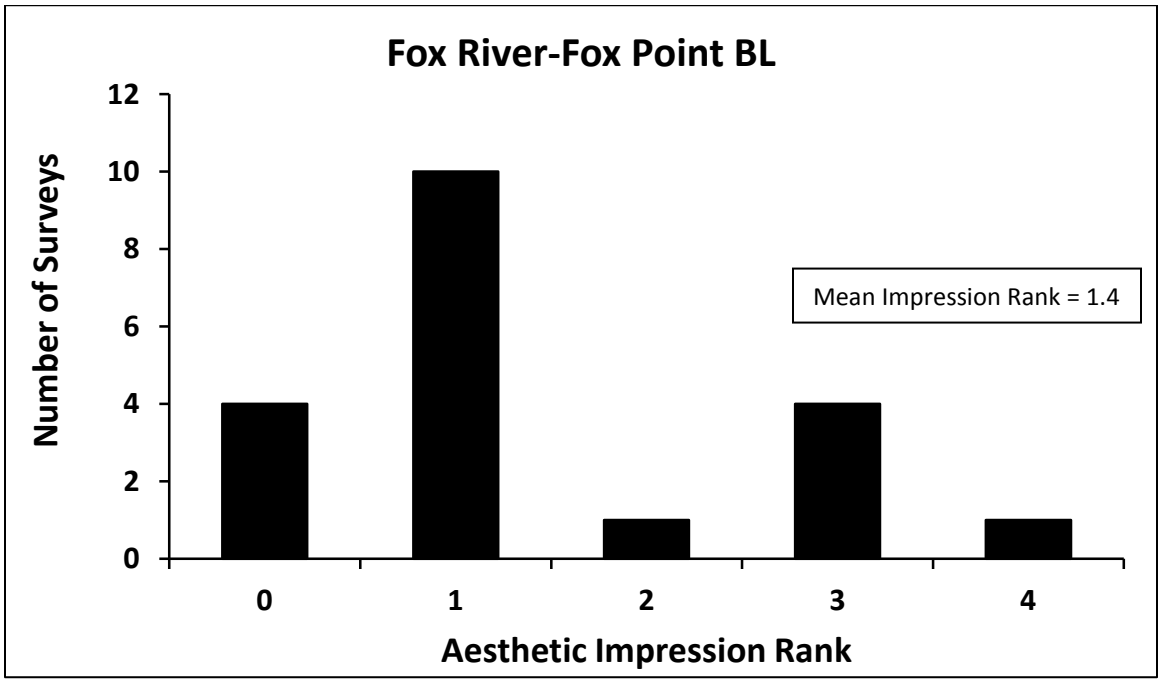



Figure 6. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Fox Point Boat Landing.

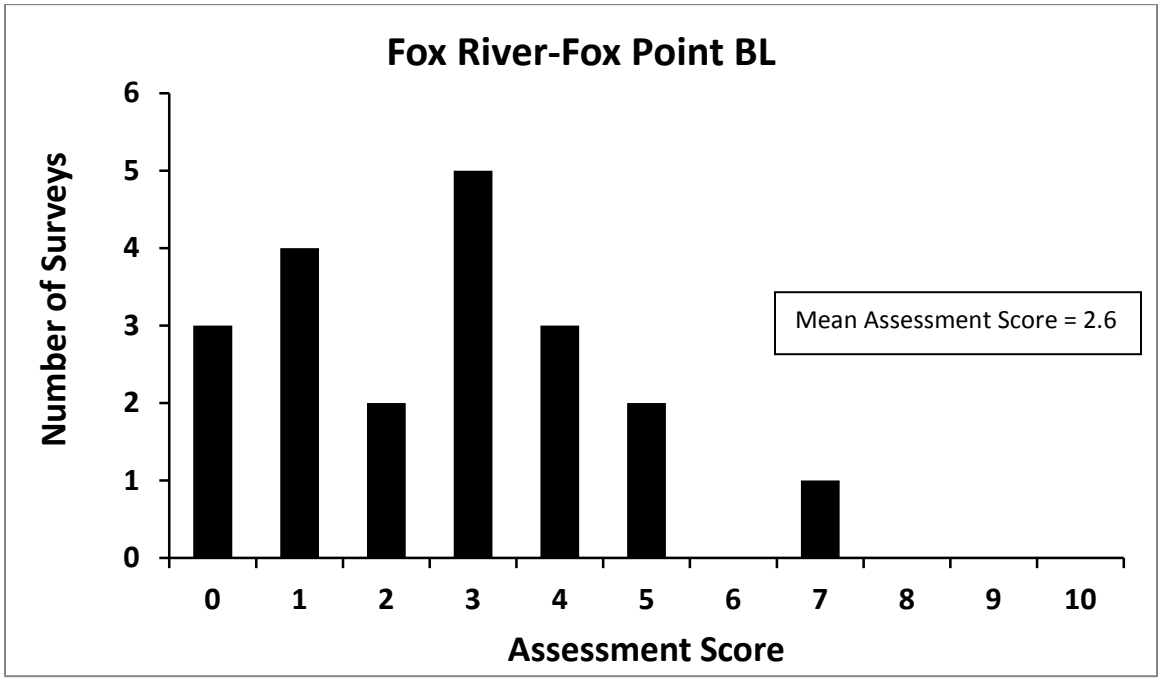



Figure 7. Assessment score and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Fox Point Landing.

Table 3. Percent (%) of surveys for the Fox River-Fox Point Boat Landing that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 6) | Summer (N = 9) | Fall (N = 5) | Total (N = 20) |
|---|---|---|---|---|
| Materials (color, odor, taste, or unsightliness) | 50 | 44 | 40 | 45 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 33 | 0 | 15 |
| Shoreline Garbage (on the shoreline or bottom) | 33 | 67 | 60 | 55 |
| Animals (on the shoreline or bottom) | 17 | 22 | 20 | 20 |
| Dead Animals (on the shoreline or bottom) | 17 | 11 | 0 | 10 |
| Invasive Species (on the shoreline or bottom) | 50 | 44 | 40 | 45 |
| Other things unpleasant (on the shoreline or bottom) | 17 | 11 | 0 | 10 |
| Floating Garbage (in the water) | 0 | 0 | 0 | 0 |
| Floating Algae (in the water) | 33 | 44 | 40 | 40 |
| Other Floating Material (in the water) | 33 | 22 | 0 | 20 |


Fox River-Fox Point Boat Landing (Phragmites), Cheryl Bougie, 07/25/13


Fox River-Fox Point Boat Landing (goose droppings), Cheryl Bougie, 07/25/13


Fox River-Fox Point Boat Landing (floating algae), Cheryl Bougie, 09/29/13

Fox River-West Lazarre Avenue

There were 16 aesthetics monitoring surveys completed during the 2011-2013 seasons. The mean impression rank for the Fox River-West Lazarre Avenue site was 1.9, falling just below the neutral (2) category (Figure 8). Assessment scores ranged from 0 to 6 and the mean assessment score was 2.8 (Figure 9). There were 4 surveys with assessment scores of 1 and 4. The most frequently selected aesthetic parameter was shoreline garbage that was selected in 69% of total surveys (Table 4). Seasonal patterns were observed with shoreline garbage selected in 75% of surveys during the summer and fall. Food related litter, street litter, and building materials were the most common items selected as displeasing for shoreline garbage. Displeasing materials also showed seasonal trends with being selected in 75% of spring surveys and 63% of summer surveys (Table 4). Floating algae was selected in 50% of total surveys, but reached 63% during the summer. Green soupy and blobs of algae were selected as the dominant forms of floating algae. Invasive species largely in the form of Phragmites were noted as displeasing in 50% of surveys during the spring and summer. Lastly, submerged garbage was selected in 33% of total surveys, but increased to 50% of surveys in summer. No other aesthetic parameter was selected in greater than 13% of total surveys and displeasing animals as well as floating garbage were not selected in any surveys (Table 4).

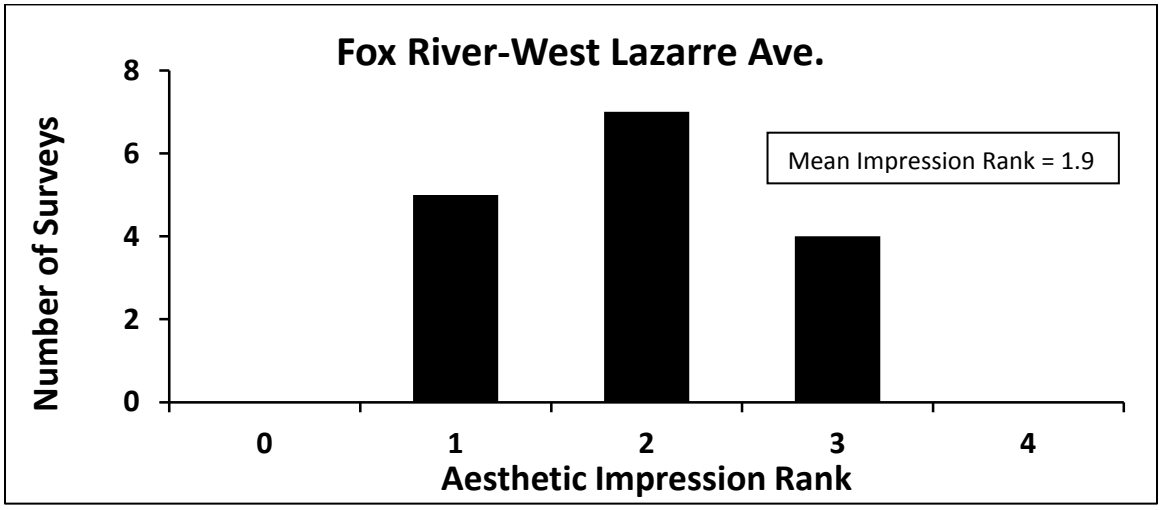



Figure 8. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-West Lazarre Avenue.

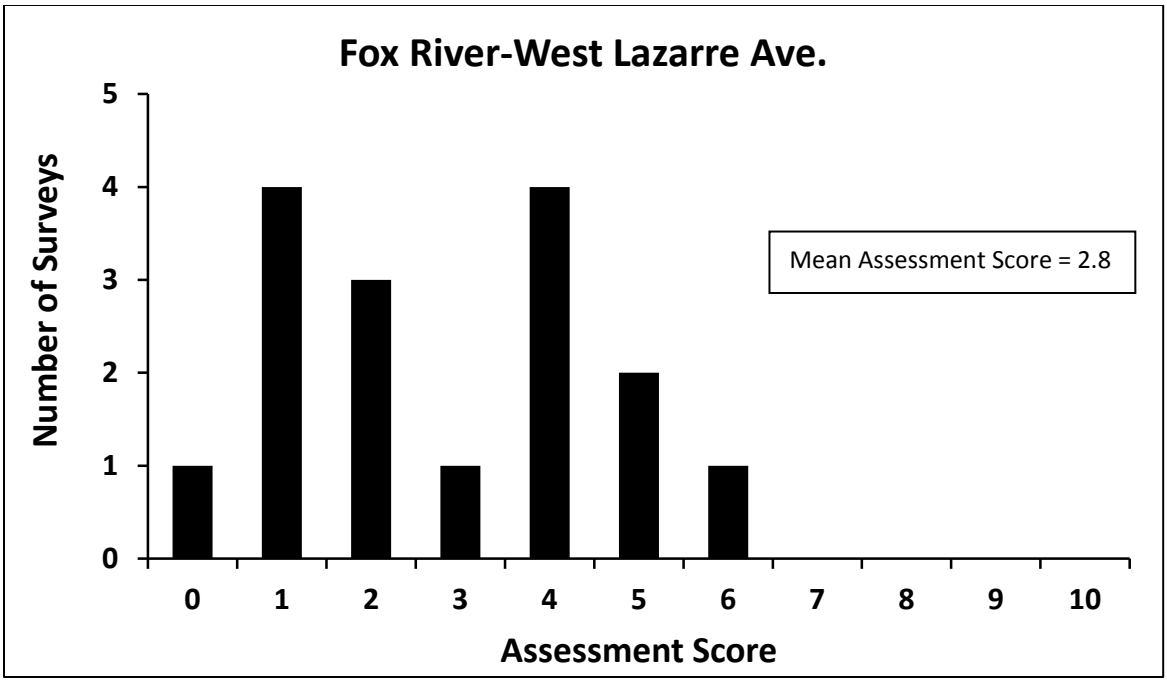



Figure 9. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-West Lazarre Avenue.

Table 4. Percent (%) of surveys for the Fox River-West Lazarre Ave. site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 4) | Summer (N = 8) | Fall (N = 4) | Total (N = 16) |
|---|---|---|---|---|
| Materials (color,ordor, taste, or unsightliness) | 75 | 63 | 25 | 56 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 50 | 25 | 31 |
| Shoreline Garbage (on the shoreline or bottom) | 50 | 75 | 75 | 69 |
| Animals (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Dead Animals (on the shoreline or bottom) | 0 | 13 | 25 | 13 |
| Invasive Species (on the shoreline or bottom) | 50 | 50 | 25 | 44 |
| Other things unpleasant (on the shoreline or bottom) | 25 | 0 | 0 | 6 |
| Floating Garbage (in the water) | 0 | 0 | 0 | 0 |
| Floating Algae (in the water) | 25 | 63 | 50 | 50 |
| Other Floating Material (in the water) | 25 | 13 | 0 | 13 |


Fox River-West Lazarre Avenue (shoreline garbage), 07/23/2012, Kaira Kamke


Fox River-West Lazarre Avenue Site, 05/31/2013, Julia Noordyk


Fox River-West Lazarre Avenue (Phragmites), 08/29/2013, Julia Noordyk

Fox River-Porlier Pier

A total of 9 aesthetics surveys were completed at the Fox River-Porlier Pier site from 2011-2013. The mean impression rank was 2.6; however, 4 surveys were ranked as somewhat displeasing and 2 as very displeasing (Figure 10). Assessment scores ranged from 0 to 4 and the mean assessment score was 2.1 (Figure 11). Despite the low assessment scores, there were several aesthetic parameters that were selected as displeasing in many surveys. Shoreline garbage and floating algae were selected in 56% of surveys, but peaks occurred in the summer when they were selected in 100% of surveys (Table 5). Food related and street litter was selected as items for shoreline garbage while floating algae was described as green soupy. Displeasing materials and submerged garbage were selected in 33% of total surveys, but some seasonal trends occurred. Aesthetic parameters that were not selected as displeasing in any surveys included dead animals, invasive species, and other things unpleasant (Table 5).

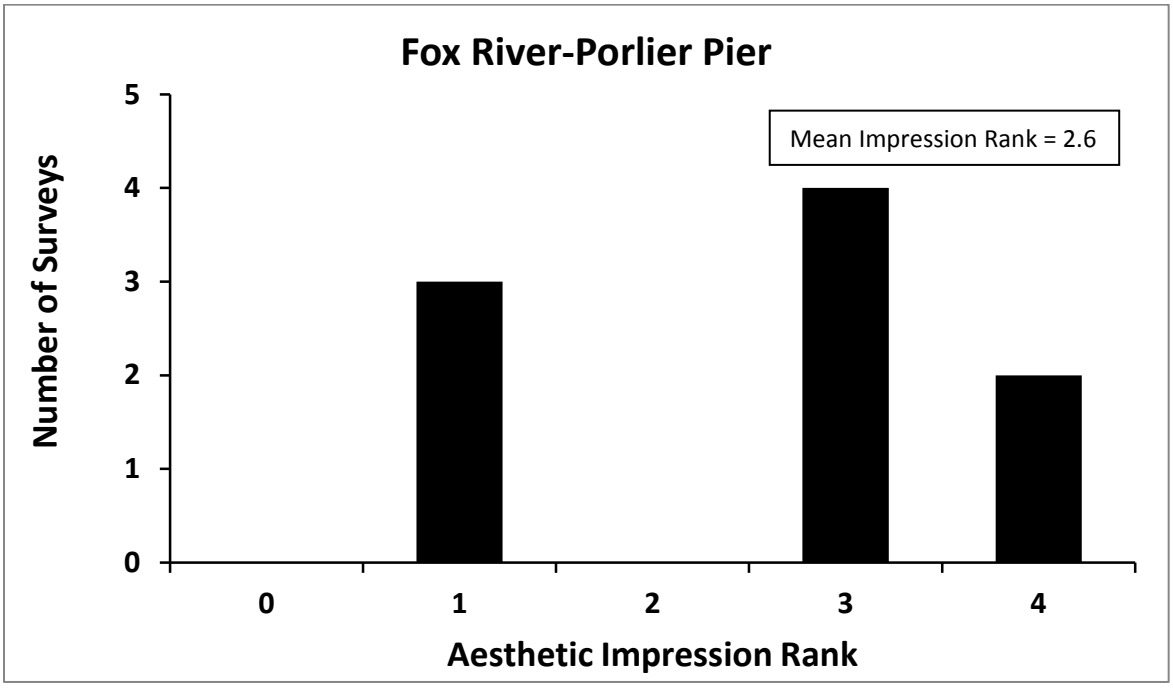



Figure 10. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Porlier Pier.

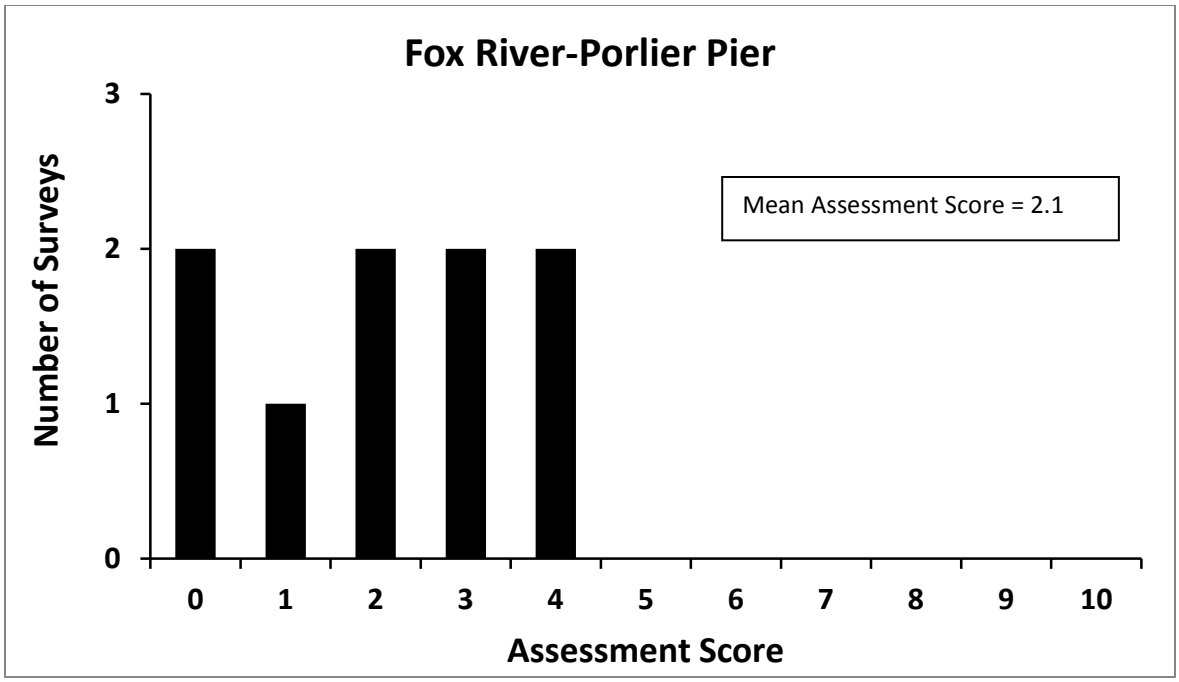



Figure 11. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Porlier Pier.

Table 5. Percent (%) of surveys for the Fox River-Porlier Pier site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 2) | Summer (N = 3) | Fall (N = 4) | Total (N = 9) |
|---|---|---|---|---|
| Materials (color,ordor, taste, or unsightliness) | 0 | 67 | 25 | 33 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 33 | 50 | 33 |
| Shoreline Garbage (on the shoreline or bottom) | 0 | 100 | 50 | 56 |
| Animals (on the shoreline or bottom) | 0 | 0 | 25 | 11 |
| Dead Animals (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Invasive Species (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Other things unpleasant (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Floating Garbage (in the water) | 0 | 33 | 0 | 11 |
| Floating Algae (in the water) | 0 | 100 | 50 | 56 |
| Other Floating Material (in the water) | 0 | 33 | 0 | 11 |


Fox River-Porlier Park Canoe Launch, 08/30/2012, Nic Sparacio


Fox River-Porlier Park (floating algae), 08/30/2012, Nic Sparacio


Fox River-Porlier Park (shoreline garbage), 11/19/2011, Jacob Jung

Fox River-Leicht Park

In 2011-2013, there were 11 aesthetics surveys completed at Fox River-Leicht Park. The mean impression rank was 1.5 and somewhat pleasing was selected the most (6 surveys; Figure 12). Assessment scores ranged from 1 to 4 and the mean assessment score was 2.6 (Figure 13). Floating algae predominately in the form of green soupy was noted displeasing in 91% of total surveys (Table 6). In the spring and summer floating algae was selected in 100% of surveys and 83% in fall. Displeasing materials including algae and goose droppings were selected in 75% of surveys during the summer and 50% in fall. Similarly, shoreline garbage was selected in 50% of surveys during the summer and fall. Displeasing factors due to animals was selected in 50% of surveys during the summer due to goose droppings. All other aesthetic parameters were selected in less than 19% of surveys (Table 6).

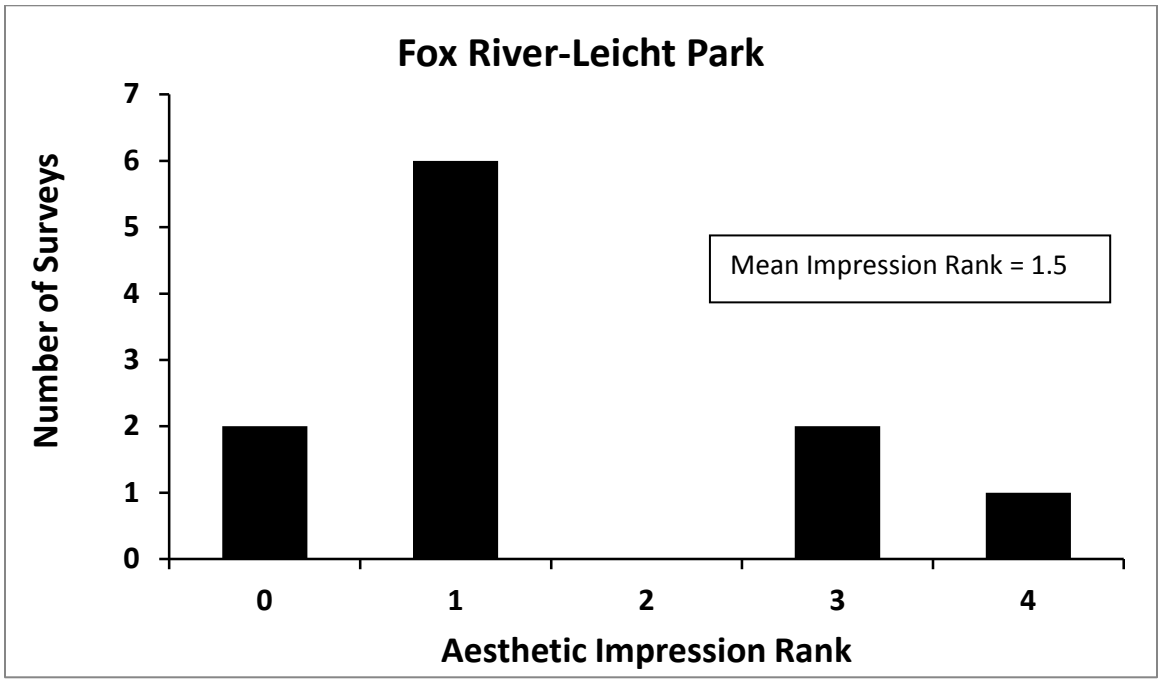



Figure 12. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Leicht Park.

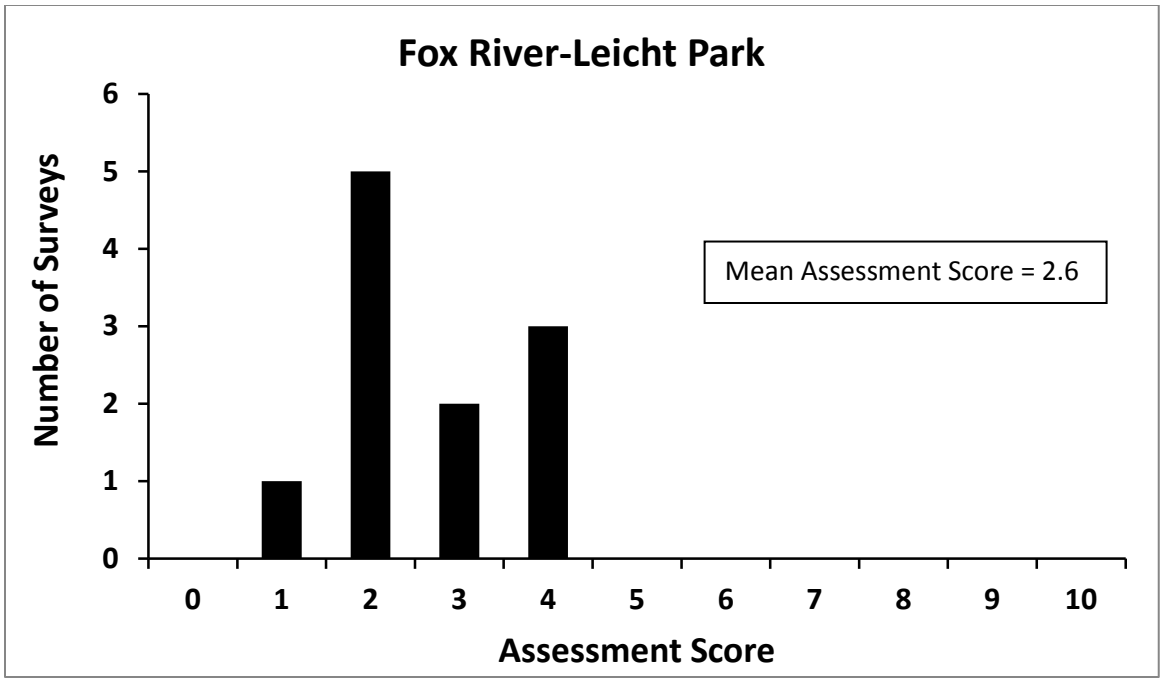



Figure 13. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Leicht Park.

Table 6. Percent (%) of surveys for the Fox River-Leicht Park site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 1) | Summer (N = 4) | Fall (N = 6) | Total (N = 11) |
|---|---|---|---|---|
| Materials (color,ordor, taste, or unsightliness) | 0 | 75 | 50 | 55 |
| Submerged Garbage (on the shoreline or bottom) | 100 | 0 | 0 | 9 |
| Shoreline Garbage (on the shoreline or bottom) | 0 | 50 | 50 | 45 |
| Animals (on the shoreline or bottom) | 0 | 50 | 17 | 27 |
| Dead Animals (on the shoreline or bottom) | 0 | 25 | 0 | 9 |
| Invasive Species (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Other things unpleasant (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Floating Garbage (in the water) | 0 | 25 | 17 | 18 |
| Floating Algae (in the water) | 100 | 100 | 83 | 91 |
| Other Floating Material (in the water) | 0 | 0 | 17 | 9 |


Fox River-Leicht Park, 10/06/2011, Ben Heiman


Fox River-Leicht Park (floating algae), 07/29/2012, Stefanie Stainton


Fox River-Leicht Park (shoreline and submerged garbage), 06/01/2013, Faye VanBeckum

Fox River-Riverview Place Park

The Fox River-Riverview Place Park had 9 aesthetics surveys completed from 2011-2013. The mean impression rank was 3.8 and 7 of 9 surveys ranked the site as very displeasing (Figure 14). Assessment scores ranged from 5 to 8 and the mean assessment score was 6.5 (Figure 15). Several aesthetic parameters were selected as displeasing in all surveys including materials, submerged garbage, shoreline garbage, and invasive species (Table 7). Several materials were listed as displeasing, but garbage and algae were listed most frequently. Common submerged garbage items included street litter, food related litter, household materials, computers, drums, and fence posts. Shoreline garbage items included street litter, food and fishing related litter, household waste and building materials. Phragmites was noted as a dominant invasive species that contributed to the site being displeasing. Floating algae largely in the form of green soupy was selected as displeasing in 89% of surveys, with 100% of summer surveys noting it as displeasing. Dead animals, floating garbage, and other things unpleasant were selected as displeasing in 33% of surveys. The only aesthetic parameter that was not selected in any surveys was displeasing factors caused by animals (Table 7).

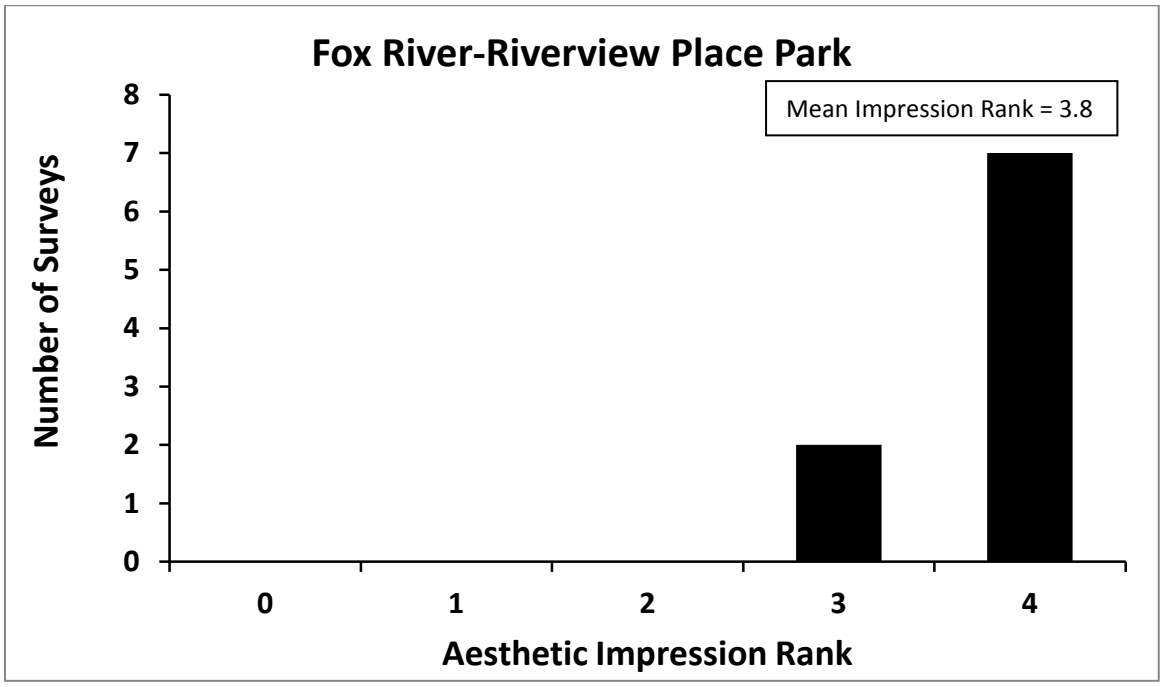



Figure 14. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Riverview Place Park.

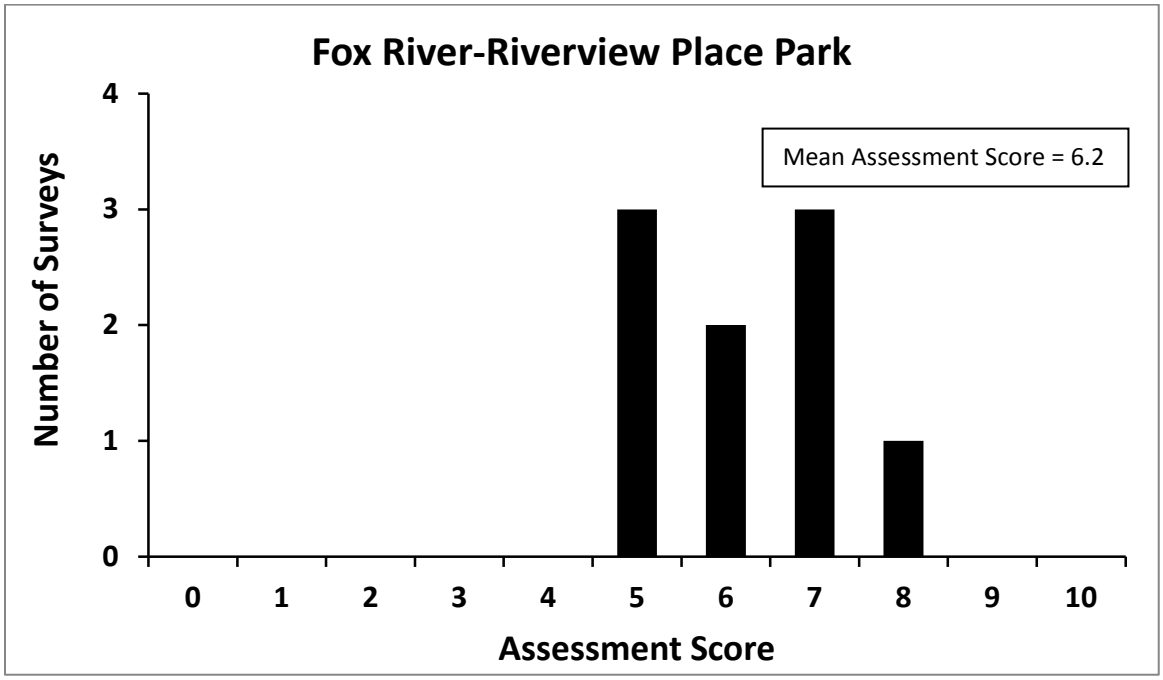



Figure 15. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Riverview Place Park.

Table 7. Percent (%) of surveys for the Fox River-Riverview Place Park site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 1) | Summer (N = 3) | Fall (N = 5) | Total (N = 9) |
|---|---|---|---|---|
| Materials (color,ordor, taste, or unsightliness) | 100 | 100 | 100 | 100 |
| Submerged Garbage (on the shoreline or bottom) | 100 | 100 | 100 | 100 |
| Shoreline Garbage (on the shoreline or bottom) | 100 | 100 | 100 | 100 |
| Animals (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Dead Animals (on the shoreline or bottom) | 100 | 33 | 20 | 33 |
| Invasive Species (on the shoreline or bottom) | 100 | 100 | 100 | 100 |
| Other things unpleasant (on the shoreline or bottom) | 0 | 67 | 20 | 33 |
| Floating Garbage (in the water) | 100 | 33 | 20 | 33 |
| Floating Algae (in the water) | 100 | 100 | 80 | 89 |
| Other Floating Material (in the water) | 0 | 33 | 20 | 22 |


Fox River-Riverview Place Park (Phragmites), 08/27/2012, Cheryl Bougie


Fox River-Riverview Place Park (shoreline garbage), 08/30/2012, Nic Sparacio


Fox River-Riverview Place Park (floating algae), 09/24/2012, Cheryl Bougie

Fox River-Metro Boat Landing

There were 14 aesthetics surveys completed at the Fox River-Metro Boat Landing in 2011-2013; however, the site did not meet the analysis criteria of having at least 3 different volunteers during at least 2 seasons. Analysis of the site was still conducted to utilize survey results and provide guidance on current site condition. The mean impression rank was 1.7 and no surveys were ranked greater than 3 (Figure 16). The assessment scores ranged from 0 to 4 and the mean assessment score was 1.5 (Figure 17). There were 6 surveys that received an assessment score of 0. Shoreline garbage was most frequently selected as displeasing; that was noted in 36% of total surveys, but during the summer it was selected in 75% of surveys (Table 8). Items selected as displeasing included street litter and food related litter. Displeasing factors caused by materials and animals was selected in 29% of total surveys and all other aesthetic parameters were selected in less than 22% of surveys (Table 8).

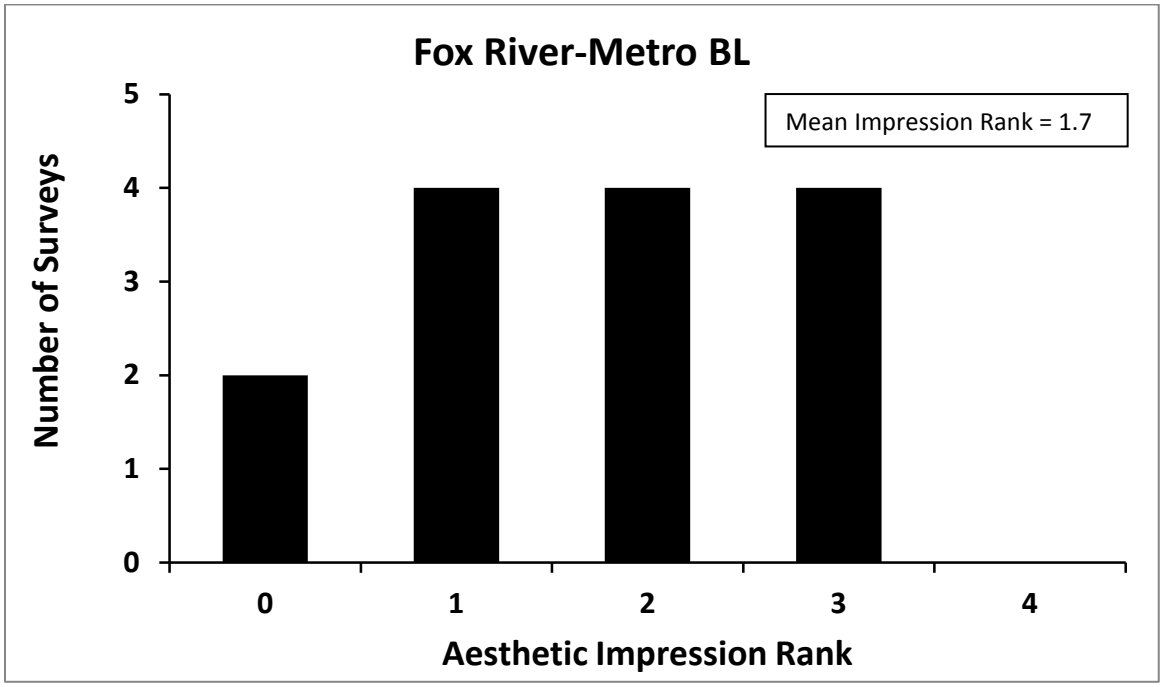



Figure 16. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Metro Boat Landing.

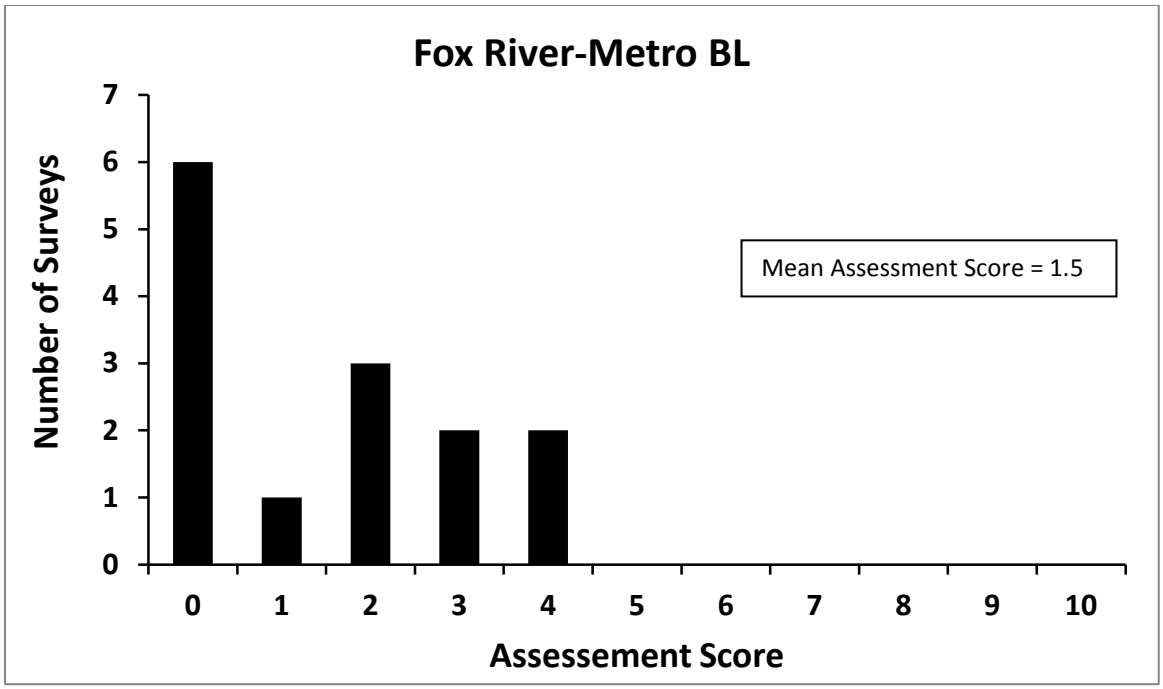



Figure 17. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Fox River-Metro Boat Landing.

Table 8. Percent (%) of surveys for the Fox River-Metro Boat Landing site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 3) | Summer (N = 4) | Fall (N = 7) | Total (N = 14) |
|---|---|---|---|---|
| Materials (color, odor, taste, or unsightliness) | 0 | 50 | 29 | 29 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Shoreline Garbage (on the shoreline or bottom) | 0 | 75 | 29 | 36 |
| Animals (on the shoreline or bottom) | 0 | 25 | 43 | 29 |
| Dead Animals (on the shoreline or bottom) | 0 | 50 | 0 | 14 |
| Invasive Species (on the shoreline or bottom) | 0 | 25 | 0 | 7 |
| Other things unpleasant (on the shoreline or bottom) | 0 | 25 | 0 | 7 |
| Floating Garbage (in the water) | 0 | 25 | 0 | 7 |
| Floating Algae (in the water) | 0 | 25 | 29 | 21 |
| Other Floating Material (in the water) | 0 | 0 | 0 | 0 |


Fox River-Metro Boat Landing (pier view), 11/07/2011, Nicole Van Helden


Fox River-Metro Boat Landing (boat dock view), 11/19/2011, Jacob Jung


Fox River-Metro Boat Landing (power plant in the distance), 09/01/2012, Kathy Lefabvre

Lake Michigan-Bay Beach

Lake Michigan Bay Beach had a total of 9 aesthetics surveys completed from 2011-2013. The impression ranks ranged from 1 to 4 and the mean was 2.6 (Figure 18). Assessment scores ranged from 2 to 7 and the mean assessment score was 4.1 (Figure 19). Several aesthetic parameters were chosen as aesthetically displeasing including materials and invasive species that were selected in 100% of total surveys (Table 9). Phragmites was noted as a dominant invasive species at the site that blocked the ability to use the site. Shoreline garbage was selected as displeasing in 89% of total surveys with street litter and food related litter items frequently found at the site. Other things unpleasant at the site were selected in 56% of surveys with weeds, grasses, and cottonwood trees noted as displeasing factors. No other aesthetic parameters were selected as aesthetically displeasing in greater than 22% of total surveys and submerged garbage, displeasing animals, and floating garbage were not selected as displeasing in any surveys (Table 9).

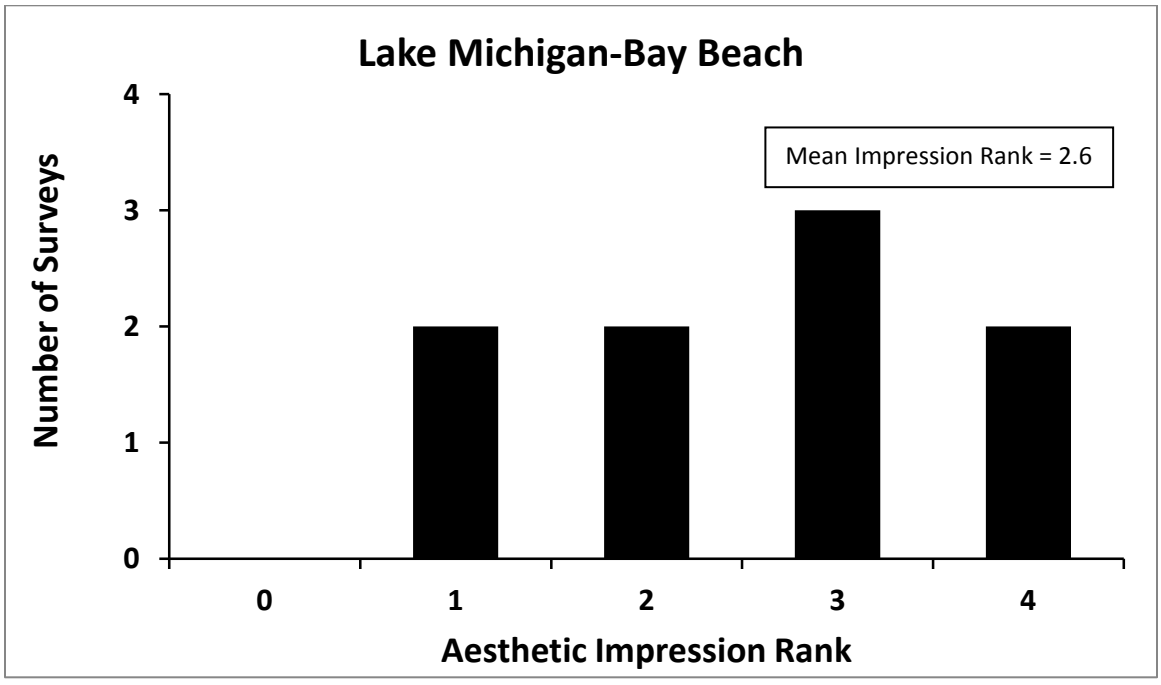



Figure 18. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Lake Michigan-Bay Beach.

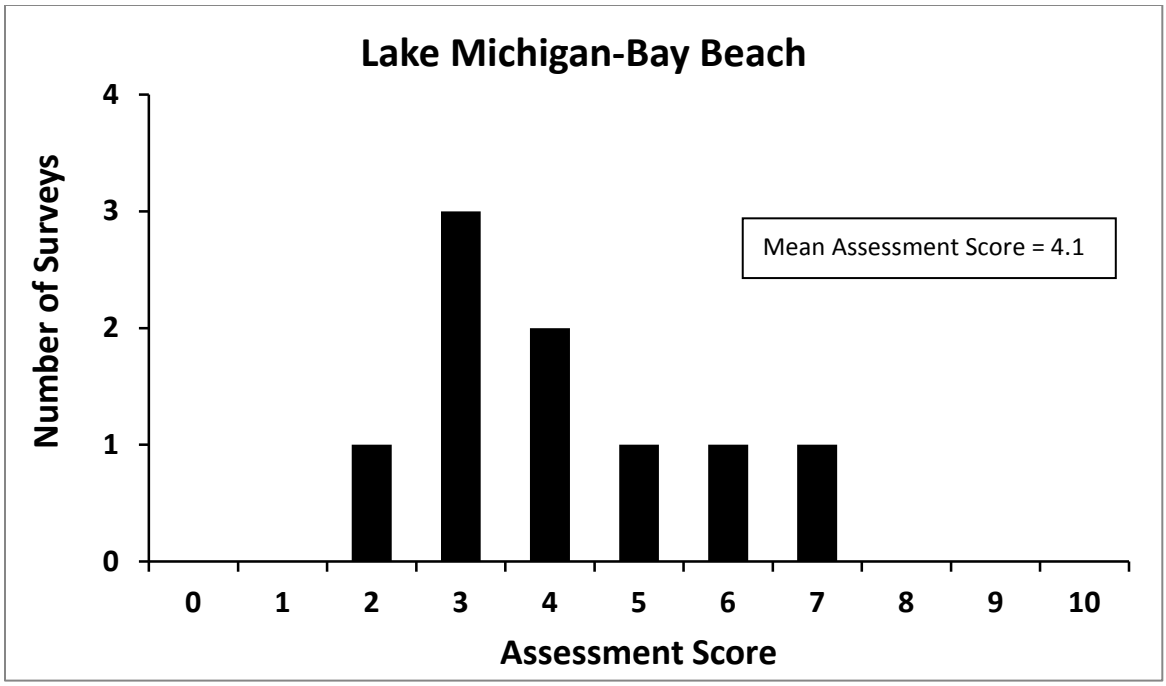



Figure 19. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Lake Michigan-Bay Beach.

Table 9. Percent (%) of surveys for the Lake Michigan-Bay Beach site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 2) | Summer (N = 3) | Fall (N = 4) | Total (N = 9) |
|---|---|---|---|---|
| Materials (color,ordor, taste, or unsightliness) | 100 | 100 | 100 | 100 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Shoreline Garbage (on the shoreline or bottom) | 100 | 100 | 75 | 89 |
| Animals (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Dead Animals (on the shoreline or bottom) | 0 | 67 | 0 | 22 |
| Invasive Species (on the shoreline or bottom) | 100 | 100 | 100 | 100 |
| Other things unpleasant (on the shoreline or bottom) | 100 | 75 | 25 | 56 |
| Floating Garbage (in the water) | 0 | 0 | 0 | 0 |
| Floating Algae (in the water) | 50 | 33 | 0 | 22 |
| Other Floating Material (in the water) | 50 | 33 | 0 | 22 |


Lake Michigan-Bay Beach (mud flats), 08/30/2012, Nic Sparacio


Lake Michigan-Bay Beach (rip rap), 09/01/2012, Kathy Lefabvre


Lake Michigan-Bay Beach (Phragmites), 09/01/2012, Kathy Lefabvre

Lake Michigan-Communiversity Park

There were 7 aesthetics surveys completed at Lake Michigan-Communiversity Park in 2011-2013; however, the site did not meet the analysis criteria of having at least 3 different volunteers during at least 2 seasons. Analysis of the site was still conducted to utilize survey results and provide guidance on current site condition. The aesthetic impression rank scores were low with a rank of 0 in 3 surveys and a rank of 1 in 4 surveys (Figure 20). The mean impression rank was 0.6 falling between very pleasing and somewhat pleasing. Mean assessment scores were also low with a mean of 1.1 (Figure 21). There were only 3 aesthetic parameters that were selected as displeasing in surveys (Table 10). Invasive species in the form of Phragmites and zebra mussels was selected in 71% of total surveys. Floating algae was only selected in 29% of total surveys, but in the summer it was selected on both surveys completed. Lastly, displeasing factors caused by animals was selected in 14% of total surveys and no other parameters were selected as displeasing in the surveys (Table 10).

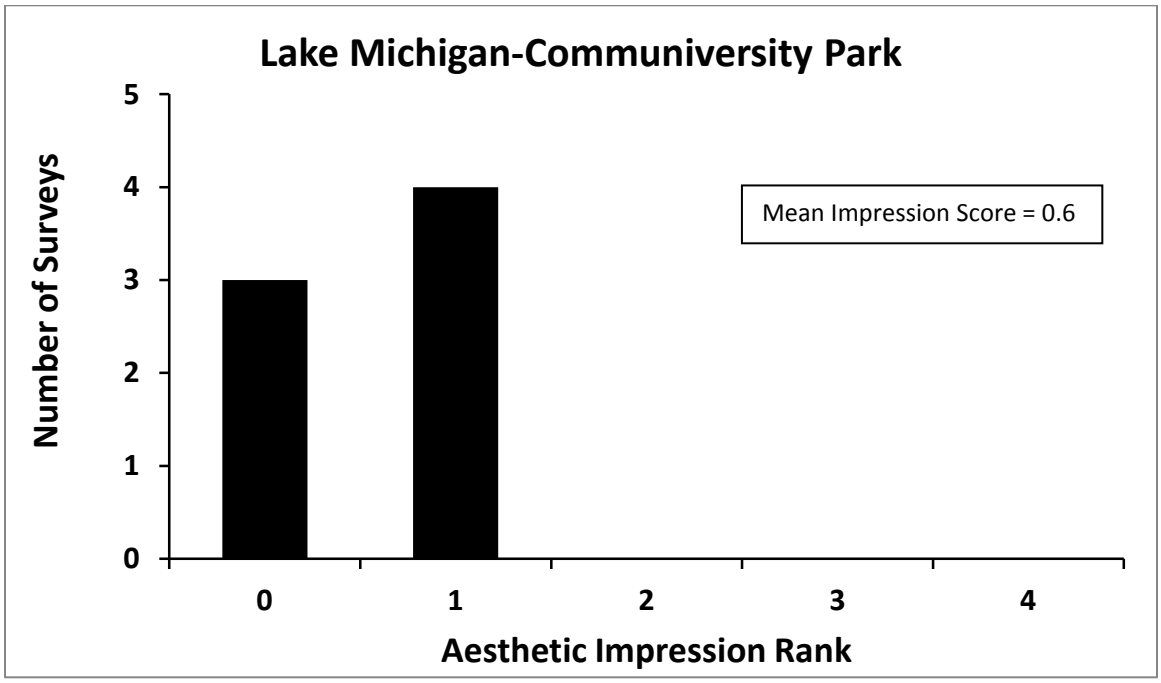



Figure 20. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Lake Michigan-Communiversity Park.

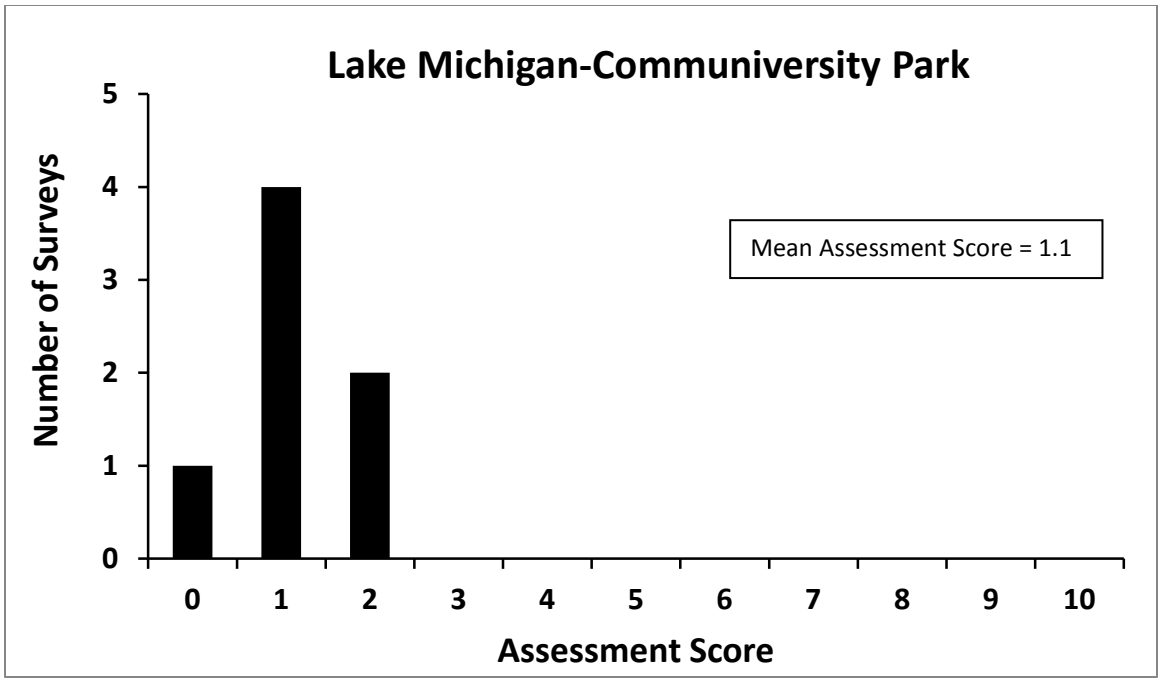



Figure 21. Aesthetic impression rank and number of surveys for the 2011-2013 aesthetics monitoring surveys at the Lake Michigan-Communiversity Park.

Table 10. Percent (%) of surveys for the Lake Michigan-Communiversity site that an aesthetic parameter was selected as displeasing. The number in parentheses under season and total indicates the number of surveys completed.

| Aesthetic Parameter | Spring (N = 2) | Summer (N = 2) | Fall (N = 3) | Total (N = 7) |
|---|---|---|---|---|
| Materials (color,ordor, taste, or unsightliness) | 0 | 0 | 0 | 0 |
| Submerged Garbage (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Shoreline Garbage (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Animals (on the shoreline or bottom) | 0 | 0 | 33 | 14 |
| Dead Animals (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Invasive Species (on the shoreline or bottom) | 50 | 50 | 100 | 71 |
| Other things unpleasant (on the shoreline or bottom) | 0 | 0 | 0 | 0 |
| Floating Garbage (in the water) | 0 | 0 | 0 | 0 |
| Floating Algae (in the water) | 0 | 100 | 0 | 29 |
| Other Floating Material (in the water) | 0 | 0 | 0 | 0 |


Lake Michigan-Communiversity Park, 06/01/2013, Faye VanBeckum


Lake Michigan-Communiversity Park (shoreline attached algae), 06/01/2013, Faye VanBeckum


Lake Michigan-Communiversity Park (floating algae), 06/01/2013, Faye VanBeckum

**Citizen Surveys**

Although we set an initial goal of 450 surveys, the actual total was much less, at 117 (see table below). One reason for this is that the student spent only 70 hours surveying out of the budgeted 200. This was partly due to his availability (he set his own hours) and partly due to the season being shorter than planned. The budget was set up with a sampling season of April through October, but he was not actually hired until late June, and he stopped surveying in early October, due to a sharp drop off in new (not already contacted) park/launch users after Labor Day.

| *Survey Location* | *Number of Surveys* |
|---|---|
| Wietor Wharf | 8 |
| Fox Point Launch | 16 |
| Leicht Park | 11 |
| Metro Boat Launch | 28 |
| Perkofski Boat Launch | 2 |
| Porlier Pier | 3 |
| Riverview Place Park | 3 |
| Voyageur Park | 28 |
| West Lazarre Avenue | 13 |
| Communiversity Park | 5 |

Numbers of visitors/users differed quite a bit between sites. Some sites—such as Voyageur Park and the Metro Boat Launch—were relatively popular, while others—such as Riverview Place Park—were not visited much. The student did not actually encounter anyone using Riverview Place Park while he was there, so the three surveys for that site were ones that he filled out himself. Also, at some sites—such as Bay Beach, West Lazarre Avenue, and Porlier Pier—there were often people in the area, but not necessarily down near the water. So, if he approached them for surveys, he made it clear that the survey questions were focused on the water and shoreline.

Survey results showed that the citizens surveyed found almost all of the sites to be aesthetically pleasing. For the overall aesthetic impression rating (Question #2), all respondents answered “very pleasing” or “somewhat pleasing,” except for one “very

displeasing" rating at Voyageur Park and "very displeasing" ratings for all three of the surveys at Riverview Place Park. As noted above, the surveyor did not encounter anyone else at the Riverview Place site, so he filled out the surveys himself. Reasons noted for the "very displeasing" impression were trash on the shore and in the water, a muddy parking area, and a generally unkept appearance. The reason given for the "very displeasing" rating at Voyageur Park was dredging in the river, which is a temporary inconvenience and beneficial in the long-term (contaminated sediment cleanup). On the other hand, folks listed a variety of factors that made the sites pleasing to them, such as a nice view, easy access, good fishing, and well-maintained trails and facilities.

Responses to Question #3 about whether there were materials present in or on the water or on the shore producing color, odor, or unsightliness to the extent that they made the area unpleasant or blocked access to the water revealed a slightly different story. When asked this more specific question, some people replied "Yes" even though they had rated the site as "very pleasing" or "somewhat pleasing" overall. The "Yes" answers were still less common than the "No" answers, except for the Riverview Place Park and Perkofski Boat Launch sites. At both of these sites, all those surveyed answered "Yes" to this question. At Riverview Place Park the problem listed was trash along the shore and in the water. At Perkofski Boat Launch the problem was the green color of the water. Interestingly, 16 people answered "No" to the first part of this question but then answered the second part ("If yes, please describe.") This was most likely due to the SWIMS question not lining up well with the actual survey question. It starts off with "List the other things that made the area unpleasant." So, if the surveyor was reading the question from SWIMS, respondents might think they should answer it even if they said "No" for the first part. Including both "Yes" and "No" answers, green or brown water, garbage, and algae were the most common answers given for the second part of this question. Other responses listed on more than one survey were poor water clarity, bird droppings, and noise.

The majority of respondents said for Question #4 referring to change in overall appearance over time that they had not noticed a change. A couple of sites were notable for

the number of people who had noticed an improvement. At Voyageur Park, 9 people out of a total of 28 surveyed said that they had noticed an improvement over time, while 14 said they had not noticed a change and 5 did not know. The most common reason given for the improvement was a decrease in garbage or trash in the area. At Metro Boat Launch, 6 people out of a total of 28 surveyed said that they had noticed an improvement over time, while 13 said they had not noticed a change, 1 noticed a change for the worse, and 8 did not know. The most common reason given for the improvement was an increase in water clarity. On the other hand, the one respondent that noticed the appearance getting worse over time noted a decrease in water clarity.

## CONCLUSIONS AND RECOMMENDATIONS

### Volunteer Monitoring

The Fox River-Riverview Place Park location was the only site to meet all three of the action criteria. The mean impression score was 3.8 while the mean assessment score was 6.2. There were 4 aesthetic parameters chosen as displeasing in 100% of surveys included displeasing materials, submerged and shoreline garbage, and invasive species. Floating algae was also selected as displeasing in 89% of surveys. No other sites met the action criteria of a mean impression rank of $\geq$ 3 or mean assessment score greater than $\geq$ 5. However, there were sites that had aesthetic parameters selected in $\geq$ 75% of the total completed surveys. The Fox River-Leicht Park had floating algae selected in 91% of surveys. Lake Michigan-Bay Beach had displeasing materials and invasive species selected in 100% if surveys as well as shoreline garbage selected in 89% of surveys. Other than the three sites described above no other sites met any of the three action criteria.

Therefore, the Fox River-Riverview Place Park, Fox River-Leicht Park, and Lake Michigan-Bay Beach are good candidates for remedial action to occur. Remedial action at Fox River-Riverview Place Park and Lake Michigan-Bay Beach could include the coordination of volunteer and public clean up events that would focus on garbage clean up. Specific items to target would include for cleanup street litter, food related litter, household materials, fishing related liter, computers, drums, and other items that are found. Floating algae was also noted as an

aesthetically displeasing problem needing more attention at the Fox River-Riverview Place Park and Fox River-Leicht Park. The algae issue is caused by the larger problem of excessive nutrients, and phosphorus in particular, being discharged upstream in the watershed. No actions are planned for these particular sites, since this is a watershed problem. The Lower Fox River and tributaries are impaired for total phosphorus and total suspended solids, and a Total Maximum Daily Load (TMDL) has been approved for the Lower Fox River Basin. The Fox River-Riverview Place Park and Lake Michigan-Bay Beach surveys also indicated an abundant amount of Phragmites that degraded the aesthetics of the site. Targeted invasive species management may be a potential option to control invasive species such as Phragmites at severely invaded sites.

In order to continue to identify problem sites, develop remedial action options, and assess the potential for removal of the degraded aesthetics BUI, additional aesthetic monitoring needs to be completed. The current monitoring program is providing useful information, and we believe it should continue in a similar form. The program is still developing, with volunteer feedback and results being used to help shape it. The 2014 citizen monitoring season should strive to meet the goal of at least three volunteers visiting each station during at least 2 different monitoring seasons, especially those sites that did not meet the requirements in 2011-2013. In order to meet this goal, additional volunteers may need to be recruited to ensure that there are enough volunteers throughout the monitoring season. Quality control should also continue to be a focus and one training event should be scheduled at the beginning of the year for all volunteers (including those from previous years) to attend. Volunteers who are unable to attend should go through a training session with the AOC Coordinator before completing surveys. The AOC Coordinator should continue to consult with the volunteers and others on how the program can be improved. Meeting these goals will continue to lead to the successful implementation of the aesthetics citizen monitoring program and provide useful recommendations for the removal of the aesthetics BUI.

**Citizen Surveys**

The 2013 citizen survey project was an initial trial in the use of short citizen surveys to gather input on the users' impressions of the survey sites being studied by the volunteer monitoring program. Although the number of surveys was small, especially for a few of the less-visited sites, the results do provide some insight about the users of the sites and their opinions on what makes each site more or less pleasing to them. In general, the citizens surveyed rated the sites as more pleasing than the volunteer monitors did, which makes some sense since these were folks using the sites for their own recreation and enjoyment, and would likely not visit sites that they did not find pleasing (at least more than once). This is probably a reason why the surveyor did not find anyone at the Riverview Place Park site.

The main advantage of this survey method is that the survey is short and relatively simple to administer, so it allows us to gather opinions from more people. Like the volunteer monitoring program, it also helps focus people's attention on our local AOC waterways, asking them to think about what they like and dislike, and what they would like to see changed. The people being surveyed are those actually using the site, rather than trained observers who might otherwise never visit the site. This might be seen as either an advantage or a disadvantage, depending on whether one's focus is the current users of the sites ("average citizens") or trained volunteers who evaluate the sites by standard criteria. In both cases, the subject matter is subjective and two people can have very different evaluations of the same site on the same date. This is why it is so important to get a variety of opinions, and why we feel that a survey of this sort should be repeated to provide data supplemental to that being collected by the dedicated volunteers.

Perhaps in 2015, another surveyor should be hired to visit the same sites, starting earlier in the season and gathering more surveys. There should be a focus on asking the questions in the same order and using the same words as the original paper survey, in case quoting the SWIMS questions caused some confusion in the 2013 surveys. Also, the surveyor should receive some guidance on how often and for how long he or she should visit the various sites, to make tracking and comparison of sites easier. The approach will depend on whether it is

deemed more important to gather more surveys overall, by focusing on the most-used sites, or to gather a minimum number of surveys per site.

Overall, we should continue to ask questions, refine our methods, and consider other ways of gathering aesthetics-related data and expanding the number of citizens included in the assessment. One possibility for expanding the program is that surveys could be completed by smart phone, such as through the pilot Wisconsin Sea Grant spatial narratives project. Another option that's been discussed is to use an event, either one already occurring in the AOC or one planned specifically for this program, to gather input from a lot of people on the same day.

**REFERENCES**

WDNR. 2009. Lower Green Bay and Fox River Area of Concern Delisting Targets. 29 pp. Accessed online 02/27/2014 at http://dnr.wi.gov/topic/greatlakes/documents/LowerGreenBayFinalReport.pdf

**APPENDIX A.**

**Volunteer Aesthetics Monitoring Program Survey Forms**

**for 2012 and 2013 with Scoring**

**Green Bay Volunteer Aesthetics Monitoring**

# MONITORING DATA SHEET

**Station ID number: _____** (Obtain Station Name and ID # from Program Staff. Please use one data sheet for each station.)

**Station Name/Location: _____**

**SWIMS Data Entered By: Name: _____ Email:_____@_____**

*If possible, please enter your site's monitoring data in SWIMS each month.* **SWIMS Website:** http://prodoasjava.dnr.wi.gov/swims

| **Describe conditions at site during this particular visit** | | | | |
|---|---|---|---|---|
| 1. Monitoring Date: (include year) | | | | |
| 2. Start Time: | | | | |
| 3. Data Collector: | | | | |
| 4. Describe water conditions: | Flat/Calm | Slight Movement | Moderate Flow/waves | Rough/Fast Flowing |
| 5. Water Level: | Don't Know | High | Low | Normal |
| 6. Did you take any pictures? Please describe. | | | | |
| **Overall aesthetic impression of the site** | | | | |
| 7. Overall, do you find the site aesthetically pleasing? Please describe. List any factors that make it pleasing or not pleasing. | Very Pleasing (0) | Somewhat Pleasing (1) | Neutral (2) | Somewhat Displeasing (3) | Very Displeasing (4) |
| | Explain: | | | | |
| 8. Have you previously evaluated this station? Y/N | Yes | | No | | |
| 9. If you have previously evalutated this station, have you noticed any changes in aesthetic quality of the water or along the shoreline since your last visit? | | | | | |
| **Materials producing color, odor, or unsightliness** | | | | |
| 10. Are any materials producing color, odor or unsightliness present to the extent that they make the area unpleasant or block your ability to access or use the water? | Yes (1) | | No (0) | |
| | Please describe | | | |
| 11. Water Color: | Clear (0) | Red Stained (1) | Green Stained (Pea Soup) (1) | Brown (Turbid) (1) |
| 12. Odor of Water: | No Smell (0) | Fishy (1) | Sulfur/Rotting Eggs (1) | Musty/Wet Soil (1) |
| | Algae/Decaying Plants (1) | | Chlorine (1) | Other (please describe)_____ (1) |
| 13. Transparency Tube 1 | | | | cm |
| Transparency Tube 2 | | | | cm |

**Substances causing objectionable deposits on shore or in bed of River/Bay**

14. Are any of the following present **on the shoreline or bottom of River/Bay** to the extent that they make the area unpleasant or block your ability to access or use the water?

| | | | | | |
|---|---|---|---|---|---|
| A. Submerged garbage - Y/N | Yes (1) | | | No (0) | |
| If yes, list visible item(s): If unidentifiable, please indicate. | | | | | |
| B. Shoreline garbage - Y/N | Yes (1) | | | No (0) | |
| If yes, circle type(s): | Street Litter | Food-related Litter | Medical Items | Resin | Sewage-related Litter |
| | Building Materials | Fishing-related Litter | | Household Waste | Other (please describe)_____ |
| C. Animals (geese, gulls, etc) - Y/N | Yes (1) | | | No (0) | |
| If yes, list type(s) and reason for problem (droppings, aggressive, etc): | | | | | |
| D. Dead animals - Y/N | Yes (1) | | | No (0) | |
| If yes, list type and amount: | | | | | |
| E. Invasive species (Phragmites, zebra/quagga mussels, other) - Y/N | Yes (1) | | | No (0) | |
| If yes, list type(s): | | | | | |
| F. Other - Y/N | Yes (1) | | | No (0) | |
| | Please describe | | | | |

15. Please indicate if any of the following are present **in the water** to the extent that they make the area unpleasant or block your ability to access or use the water:

| | | | | | |
|---|---|---|---|---|---|
| A. Floating Garbage - Y/N | Yes (1) | | | No (0) | |
| If yes, estimated percent of floating garbage on water surface: (see attached directions for estimation) | | | | | % |
| If yes, please list circle type(s): | Street Litter | Food-related Litter | Medical Items | Resin | Sewage-related Litter |
| | Building Materials | Fishing-related Litter | | Household waste | Other (please describe)_____ |
| B. Surface Water Description: | Normal | Oily Sheen | | Neon Green Sheen | Foamy |
| | Floating Aquatic Plants | | Natural Debris | Other (please describe)_____ | |
| C. Algae - Y/N | Yes (1) | | | No (0) | |
| If yes, estimated percent of algae on water surface: (see attached directions for estimation) | | | | | % |
| If yes, please circle type(s): | Blobs of Floating Material | | | Green Soupy | Matted |
| | Attached to Rocks/Stringy | | | Other (please describe)_____ | |
| If yes, please circle color: | Light Green | | Blue Green | | Dark Green |
| | Brown | Red | Yellow | Other (please describe)_____ | |
| D. Other - Y/N | Yes (1) | | | No (0) | |
| | Please describe | | | | |

| **Survey END** | |
|---|---|
| 16. While filling out this survey, please describe the most difficult task (if any) | |
| 17. Comments:<br>Please include anything else you though should be reported while completing out this survey. (Please use back for additional comments) | |
| 18. End Time: | |
| 19. Date the data were entered in SWIMS: | |
| **QA/QC: (for DNR use only)** | |

**Green Bay AOC Volunteer Aesthetics Monitoring**

# MONITORING DATA SHEET

**Station Name/Location:** _____

**Demographic information:**

**Sex: (please circle)** **M** **F** **Age:** _____

**What county do you live in?**_____ **How many years have you lived in the county?**_____

**Approximately how many times have you visited this location in the past 10 years? If this is your first visit enter 1.** _____

**Describe conditions at site during this particular visit** ** Please fill out all questions on the datasheet completely and to the best of your ability.

| | | | | |
|---|---|---|---|---|
| **1.** Data Collector (Your Name): | | | | |
| **2.** Monitoring Date (MM/DD/YY): | | | | |
| **3.** Start Time (include AM/PM): | | | | |
| **4.** Describe water conditions: | Flat/Calm | Slight Movement | Moderate Flow/waves | Rough/Fast Flowing |
| **A.** Water Level: | Don't Know | High | Low | Normal |
| **5.** Did you take any pictures? Please describe.<br><br>please email pictures with location and date information to laurel.last@wisconsin.gov | Yes | | No | |

**Overall aesthetic impression of the site**

| | | | | | |
|---|---|---|---|---|---|
| **6.** Overall, how aesthetically pleasing do you find the site? Please describe. List any factors that make it pleasing or not pleasing. | Very Pleasing (0) | Somewhat Pleasing (1) | Neutral; neither pleasing nor displeasing (2) | Somewhat Displeasing (3) | Very Displeasing (4) |
| | Explain: | | | | |

**Color, Clarity, Odor, or Unsightliness**

| | | |
|---|---|---|
| **7.** Are any **materials** detectable to you such that they produce color, odor, or unsightliness to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water? | **Yes (1)** | **No (0)** |
| | Please describe | |
| **8.** Are the characteristics **of the water** (Color, Clarity, Odor) presenting an unsightliness to the extent that they make the area unpleasant or block your ability to access, enjoy or use the water? | **Yes (1)** | **No (0)** |
| | Please describe | |

**9.** Please describe the characteristics of the water during this particular visit. Characteristics may be present or absent regardless of their ability to make the area unpleasant or block your ability to access, enjoy, or use the water (Question 8).

| | |
|---|---|
| **A. Water Color:** | Colorless Red Green Brown Other (please describe)_____ |
| **B. Water Clarity:** | Completely Clear Fairly Clear Fairly Cloudy Completely Cloudy |
| (optional) Transparency Tube 1 | **CM** |
| Transparency Tube 2 | **CM** |
| **C. Odor of Water:** | No Smell Fishy Sulfur/Rotting Eggs Musty/Wet Soil |
| Choose all that apply | Algae/Decaying Plants Chlorine Other (please describe)_____ |
| **D. Water Surface:** | Normal Oily Sheen Neon Green Sheen Foamy Floating Aquatic Plants |
| Choose all that apply | Natural Debris Natural Debris Jams Other (please describe)_____ |

**Substances causing objectionable deposits on shore or on the bottom of river**

**10.** Are any of the following visible to you **along the shoreline or on the bottom of the river** to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water?

| | |
|---|---|
| **A. Garbage on the bottom - Y/N** | **Yes (1)** **No (0)** |
| If yes, list visible item(s): If unidentifiable, please indicate. | Street Litter Food-related Litter Medical Items Household Waste Sewage-related Litter<br>Building Materials Fishing-related Litter Other (please describe)_____ |
| **B. Shoreline garbage - Y/N** | **Yes (1)** **No (0)** |
| If yes, circle type(s): | Street Litter Food-related Litter Medical Items Household Waste Sewage-related Litter<br>Building Materials Fishing-related Litter Other (please describe)_____ |
| **C. Algae - Y/N** | **Yes (1)** **No (0)** |
| If yes, estimate percent of algae on shoreline or on the bottom: (see attached directions for estimation) | **%** |
| If yes, please circle type(s): | Blobs of Floating Material Green Soupy Matted<br>Attached to Rocks/Stringy Other (please describe)_____ |
| If yes, please circle color: | Light Green Blue Green Red Dark Green<br>Brown Yellow Other (please describe)_____ |
| **D. Problem animals or problems caused by animals -Y/N** | **Yes (1)** **No (0)** |
| If yes, list type(s) and reason for problem(s): | |
| **E. Dead animals - Y/N** | **Yes (1)** **No (0)** |
| If yes, list type and amount: | |
| **F. Invasive species (e.g., Phragmites, zebra/quagga mussels, other) - Y/N** | **Yes (1)** **No (0)** |
| If yes, list type(s): | |
| **G. Other (shoreline or on the bottom) - Y/N** | **Yes (1)** **No (0)**<br>Please describe |

| **Substances causing objectionable deposits floating or suspended in the water** | |
|---|---|
| **11.** Are any of the following visible to you **floating or suspended in the water** to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water? | |
| **A. Garbage - Y/N** | **Yes (1)** **No (0)** |
| If yes, estimate percent of garbage floating or suspended in the water: (see attached directions for estimation) | **%** |
| If yes, please list circle type(s): | Street Litter; Food-related Litter; Medical Items; Household waste; Sewage-related Litter; Building Materials; Fishing-related Litter; Other (please describe)_____ |
| **B. Algae - Y/N** | **Yes (1)** **No (0)** |
| If yes, estimate percent of algae floating or suspended in the water: (see attached directions for estimation) | **%** |
| If yes, please circle type(s): | Blobs of Floating Material; Green Soupy; Matted; Attached to Rocks/Stringy; Other (please describe)_____ |
| If yes, please circle color: | Light Green; Red; Blue Green; Dark Green; Brown; Yellow; Other (please describe)_____ |
| **C. Other (floating or suspended in the water) - Y/N** | **Yes (1)** **No (0)** Please describe |
| **Survey END** | |
| **12.** Have you previously evaluated this station? Y/N | Yes No |
| **13.** If you have previously evaluated this station, what changes if any have you noticed in the aesthetic quality of the water or along the shoreline since your last visit? | |
| **14.** While filling out this survey, please describe the most difficult task (if any). | |
| **15.** Comments: Please include anything else you thought should be reported while completing out this survey. (Please use back for additional comments) | |
| **16.** End Time: | |
| **Date the data were entered in SWIMS: (include data entered by)** | |
| **QA/QC: (for DNR use only)** | |

**If you have questions or to return this survey, please contact Laurel Last (Laurel.last@Wisconsin.gov) at WI DNR, 2984 Shawano Avenue, Green Bay, WI 54313**

## APPENDIX B.

## Volunteer Aesthetics Monitoring Program Instructions for 2013

**Volunteer Aesthetics Monitoring – Datasheet Instructions**
Question by question instruction to Green Bay AOC Aesthetics Monitoring (Follow along with datasheet)

****Please evaluate water and immediate shoreline. Refrain from including anything on land in your assessment. ****Please fill out all questions on the datasheet completely and to the best of your ability.**

**Contact Laurel Last with any questions – laurel.last@wisconsin.gov**

***Header***
**Station Name/Location**- Enter station name here. If you do not know, please describe your location.
**Demographic information –** Please answer to the best of your knowledge.

***Describe conditions at site during this particular visit***

1. **Data Collector** (your name) - The name of the team member filling out the datasheet.
   **Because of the subjectivity of most of the questions, only one person may fill out the datasheet. If there are multiple people present during field event, please fill out separate datasheets.**

2. **Monitoring Date**- The date of the field event. Enter as MM/DD/YY.

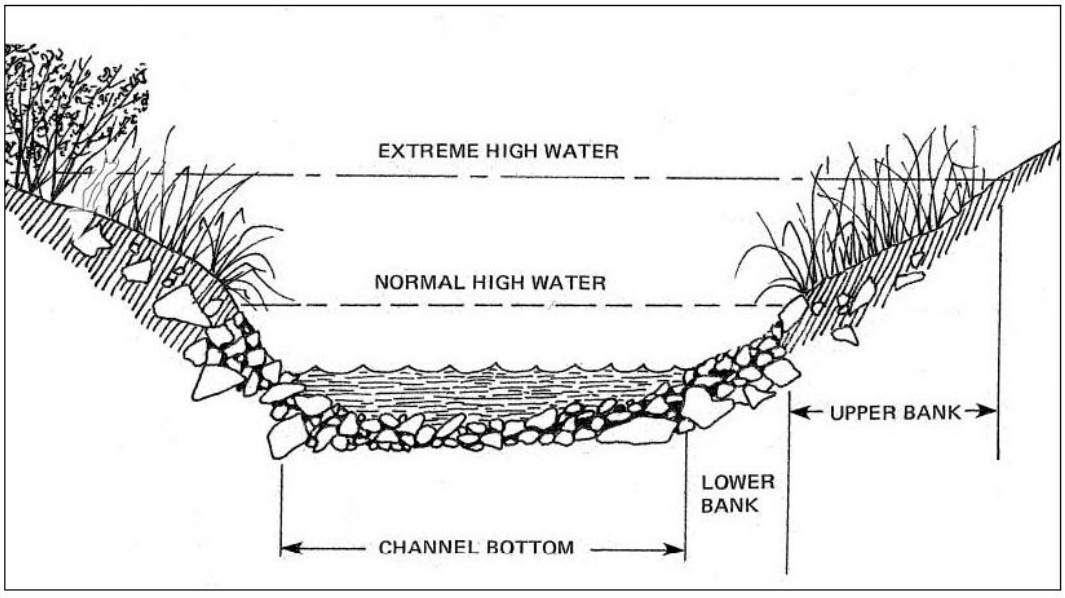
3. **Start Time**- The time you arrived at the station. Include AM/PM.

4. **Describe water conditions**- Please choose from the following: Flat/Calm, Slight Movement, Moderate Flow/Waves, Rough/Fast Flowing

   A. **Water Level**- Please record the water level of the area. Choose from the following: Don't Know, High, Low, Normal.

How to describe water level: This is something that you will feel more comfortable with assessing the more you visit your stream site. Some things to look for when you first visit your site to help you make the assessment are:

- Look to see if terrestrial vegetation along banks is submerged. The terrestrial vegetation will end at the normal high water mark.
- Look for water stains on rocks or bridge abutments. Water will stain rocks if it flows over or by them for an extended period of time. If you see stains above the level of water in the stream during your visit, the level is likely low.




*This diagram shows a cross section of a typical streambank, demarcating the upper and lower banks.*

5. **Did You Take Any Pictures? Y/N Please Describe**- Number your pictures in order and describe what you are photographing. Example: Photo 1 on 7/15/11, From east shoreline looking upstream. Photo 2 on 7/15/11, garbage on the beach is aesthetically displeasing. Take pictures to show why you think the station is pleasing or displeasing.

***Overall aesthetic impression of the site***

6. **Overall, Do You Find the Station Aesthetically Pleasing? Please Describe Why**- Please choose from the following: Very Pleasing, Somewhat Pleasing, Don't Know, Somewhat Displeasing, Very Displeasing. Please follow up your response with an explanation.

***Color, odor, or unsightliness***

7. **Are any <u>materials</u> producing color, odor or unsightliness present to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water? Answer YES or NO. If YES please describe.** – Look around your station and describe in the provided space if there is anything that fits the description above.

8. **Are the characteristics <u>of the water</u> (color, clarity, odor) presenting an unsightliness to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water? Answer YES or NO. If YES please describe.** – Look around your station and describe in the provided space if there is anything that fits the description above.

9. **Please describe the characteristics of the water during this particular visit. <u>Characteristics may be present or absent regardless of their ability to make the area unpleasant or block your ability to access, enjoy, or use the water</u>.** Please answer for the following categories:

    A. **Water Color** - Describe the color of the water from where you are standing. Please choose from the following: Clear, Red, Green, Brown, or Other (Please Describe). Please leave this section blank if you are colorblind.

    B. **Water Clarity** - Please describe the clarity of the water while looking from the shore. Please choose the best answer: Completely Clear, Fairly Clear, Fairly Cloudy, and Completely Cloudy.

    **In addition to the water clarity question it is optional to take a Transparency Tube reading.

**Transparency Tube** - <u>How to measure transparency:</u> Collect the sample away from the bay or stream bank in the main flow (well-mixed) area. Be careful not to disturb the bottom when you collect the water sample. If you get sediment from bottom disturbances, dump out the sample, and move upstream away from the disturbed area and try again. To collect a sample while standing on the shore, use a bucket or sample bottle attached to a pole so that you can reach off-shore. Scoop from below the surface in the upstream direction. Be careful not to stir up the sediment upstream of your sample. Pour the sample into the transparency tube through the nylon stocking provided.

**Reading the Transparency Tube**

For the observer, consistency is the key. If you initially wear your eyeglasses when you take the reading, then always wear your eyeglasses to take this measurement. Never wear sunglasses when you take this reading.

1. Remove large objects from the water sample. Filter through nylon stocking provided.
2. If the sample has settled, use a stirring stick to stir the sample, or pour the sample into a clean bucket and back into the transparency tube to suspend all materials.

3. Stand out of direct sunlight. If you cannot get to a shady place, use your body to cast a shadow on the tube (Figure 1).
4. If you are wearing sunglasses, remove them. Then look for the target (black and white) disc on the bottom of tube. If disc is visible, record the length of the tube (e.g., 120 cm) on the data sheet.
5. If target disc is not visible, have your partner let water out a little at a time using the valve at the bottom until disc is just visible (Figure 2). Have them stop letting water out immediately when you can just see the contrast between black and white on the disc.
6. Read the level of water in the tube in cm using the measuring tape on the side of the tube.
7. Record the measurement on your data sheet in cm.
8. Dump contents of tube on ground.
9. Collect a new sample then repeat steps 1 through 8.
10. Record the second measurement in cm on your data sheet.

Figure 1: Transparency tube shaded by observer.

Figure 2: Releasing water until the disk is just visible.

***Question 9 continued:***

C. **Odor of Water -** Please describe the smell, if any, coming from the water. Be sure not to describe odors from other areas, such as, a nearby garbage can or the city. Choose from the following options: No Smell, Fishy, Sulfur/Rotting Eggs, Algae/Decaying Plants, Musty/Wet Soil, Chlorine, or Other Smell (Please Describe). You may choose more than one odor of the water.

D. **Water surface -** Describe the condition of the surface of the water body. Please choose from the following: Normal, Oily Sheen, Neon Green Sheen, Foamy, Floating Aquatic Plants, Natural Debris (Example: sticks, leaves), Natural Debris Jams (Example: enough natural debris and potentially garbage that causes jamming), Other (please describe).

***Substances causing objectionable deposits on shore or on the bottom of the Waterbody***

10. **Are any of the following present on the shoreline or bottom of the waterbody <u>to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water</u>?**
******If the substance IS present, and is NOT to the extent that it makes the area unpleasant or blocks your ability to access, enjoy, or use the water; answer No and do not describe.

    A. **Garbage on the bottom** – Answer YES or NO
    **If Yes, circle type(s)** – If you are able to see what the submerged item is, please identify. Use the chart below and circle the type of garbage present. You can select more than one. If you are unable to identify item, do your best to describe.

    B. **Shoreline Garbage** – Answer YES or NO
    **If Yes, circle type(s) --** Use the chart below and circle the type of garbage present. You can select more than one. If you circle 'Other', please describe.

| Type | Street litter | Food-related litter | Medical items | Sewage-related | Building materials | Fishing related | Household waste | Other |
|---|---|---|---|---|---|---|---|---|
| **Example** | Cigarette filters | Food packing, beverage containers | Syringes | Condoms, tampons | Pieces of wood, siding | Fishing line, nets, lures | Household trash, plastic bags | Any garbage not represented |

    C. **Algae** – Answer YES or NO
    **If Yes, estimate percent of algae-** <u>Only list algae if it causes the area to be unpleasant or block your ability to access, enjoy, or use the water.</u> Please estimate the percent of algae using the attached figure. Please use an exact number rather than a range.

    **If Yes, circle type(s)** – Please describe the type of algae present. Choose from the following: Blobs of Floating Material, Green Soupy, Attached to Rocks/Stringy, Matted, Other (please describe). You may record more than one type of algae.

    **If Yes, circle color –** Please record the color of algae present. Choose from the following: Light Green, Blue Green, Dark Green, Brown, Red, Yellow, Other (please describe). You may record more than one color of algae. Please leave this section blank if you are colorblind.

    D. **Problem Animals or problems caused by animals**– Answer YES or NO
    **If Yes, list type(s) and reason for problem.** <u>Only list animals or problems if they cause the area to be unpleasant or block your ability to access, enjoy, or use the water.</u> Problems caused by animals may still be present even if the animal is not at the time of the survey.

    E. **Dead Animals** – Answer YES or NO
    **If Yes, list type(s) and amount –** <u>Only list dead animals if they cause the area to be unpleasant or block your ability to access, enjoy, or use the water.</u> Please record amount using a whole number. Avoid using ranges (12 instead of 10-15).

F. **Invasive Species (e.g., Phragmites, zebra/quagga mussels, other)** – Answer YES or NO
**If Yes, list type(s) and amount** – Only list invasive species if they cause the area to be unpleasant or block your ability to access, enjoy, or use the water. If you are able to identify invasive species located at the station, please record the species and amount.

G. **Other (shoreline or on the bottom)** – Answer YES or NO. Is there anything else that does not fit in the categories above that is present along the shoreline or bottom of the waterbody to the extent that they make the area unpleasant or block your ability to enjoy the water? If so, please describe in the space provided.

***Substances causing objectionable deposits floating or suspended in the water***

11. **Are any of the following visible to you floating or suspended in the water to the extent that they make the area unpleasant or block your ability to access, enjoy, or use the water –** Please answer all of the following categories:
    A. **Garbage** – Answer YES or NO
    **If Yes, estimate percent of garbage floating or suspended in the water** - Only list garbage if it causes the area to be unpleasant or block your ability to access, enjoy, or use the water. Use the attached figure to help you estimate percentages. Please use an exact number rather than a range.

    **If Yes, please circle type(s)** – Use the chart in question 10-A and B and circle the type of garbage present. You can select more than one. If you circle 'Other', please describe.

    B. **Algae** – Answer YES or NO
    **If Yes, estimate percent of algae floating or suspended in the water -** Only list algae if it causes the area to be unpleasant or block your ability to access, enjoy, or use the water. Please estimate the percent of algae present using the attached figure. Please use an exact number rather than a range.

    **If Yes, circle type(s)** – Please describe the type of algae present, if any. Choose from the following: Blobs of Floating Material, Green Soupy, Attached to Rocks/Stringy, Matted, Other (please describe). You may record more than one type of algae if present.

    **If Yes, circle color –** Please record the color of algae present, if any. Choose from the following: Light Green, Blue Green, Dark Green, Brown, Red, Yellow, Other (please describe). You may record more than one color of algae if present. Please leave this section blank if you are colorblind.

    C. **Other (suspended or floating in the water)** – Answer YES or NO. Is there anything else that does not fit in the categories above that is present in the water to the extent that they make the area unpleasant or block your ability to access the water? If so, please describe in the space provided.

***Survey End***

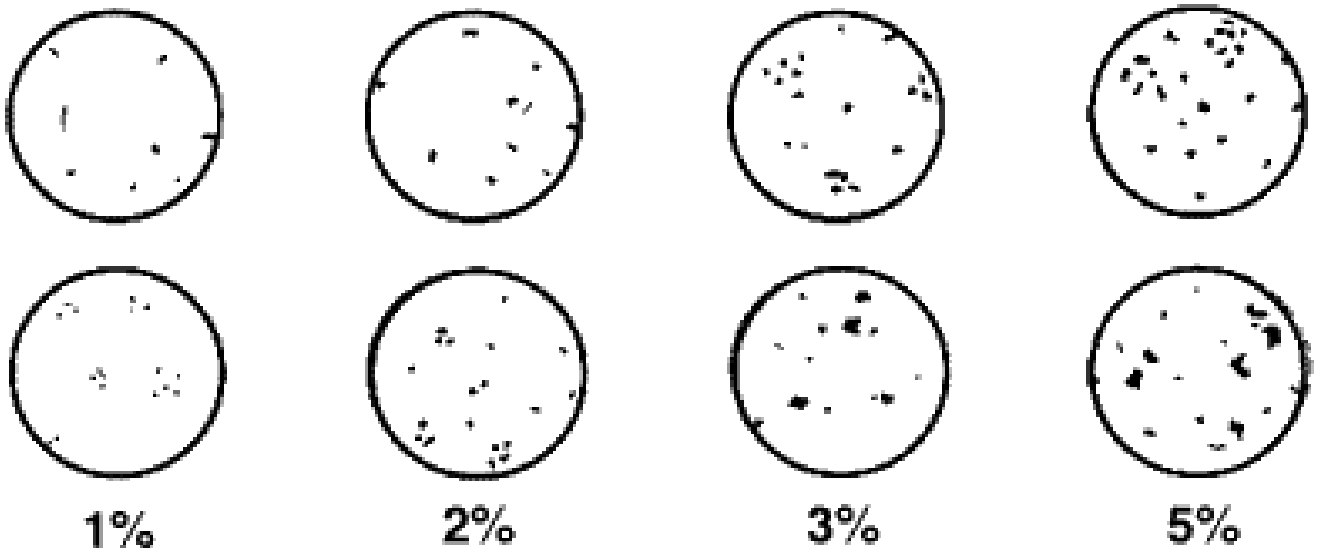
12. **Have You Previously Evaluated This Station? -** Answer YES or NO

13. **If you have previously evaluated this station, what changes if any have you noticed in the aesthetic quality of the water or along the shoreline since your last visit?** - Describe any changes in the space provided on the datasheet.

14. **While filling out this survey, please describe the most difficult task (if any**) – Did you find a particular question difficult to answer or task difficult to complete? Please record that here.

15. **Comments** – Record any additional comments in the space provided. Consider things that you thought should be reported but where not asked. (Weather conditions, unique animal sightings, etc.)

16. **End Time –** Please record the time the field was completed. **Thank You!**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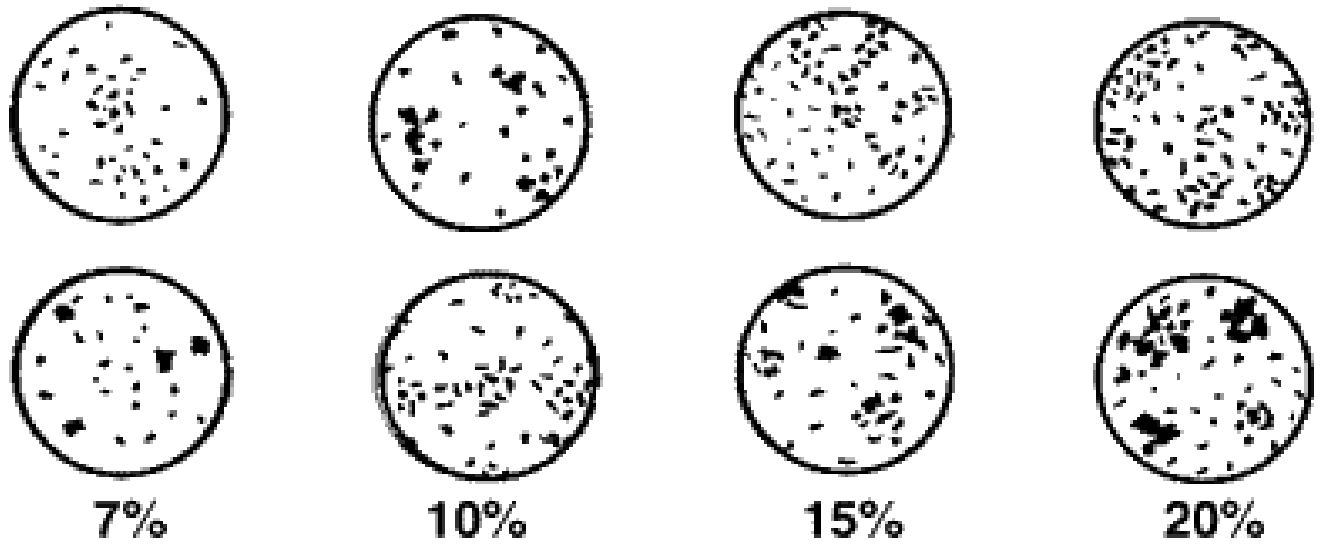
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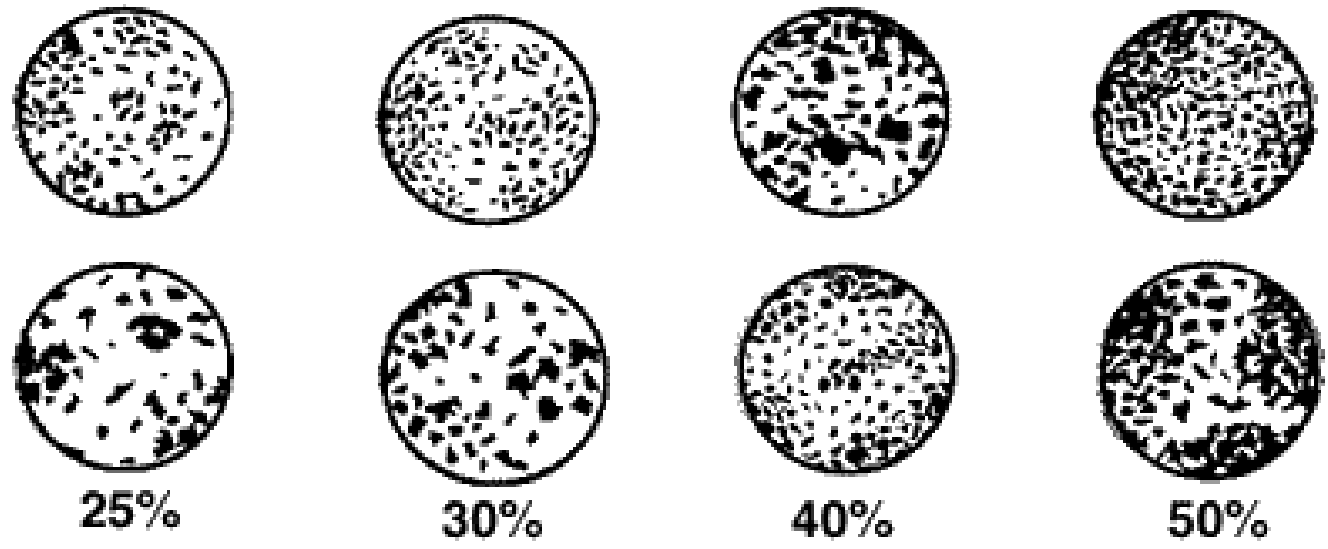
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**APPENDIX C.**

**2013 Citizen Survey Project Survey Form**

# Lower Green Bay and Fox River Aesthetics Monitoring Project Citizen Survey

1. How many years have you been visiting this site? If this is the first year, answer "**1**." _____

2. Overall, how pleasing (beautiful) do you find the site? Please choose one of the following options, focusing on the water and the immediate shoreline:

   Very Pleasing  Somewhat Pleasing  Neutral  Somewhat Displeasing  Very Displeasing

   Please list any observations that make it pleasing or displeasing.

_____

_____

_____

3. Are you aware of any materials present in the water, on the water, or on the shore that produce color, odor, or unsightliness to the extent that they make the area unpleasant or block your ability to access or use the water? YES NO

If Yes, please describe. _____

_____

_____

4. Have you noticed a change in the overall appearance of the water or shoreline at this site over time?

   Yes, improved  Yes, got worse  No, no change  Don't know

If Yes, please describe. _____

_____

5. Background information: Sex (please circle): M F Age: _____

   Is Wisconsin your primary residence? YES NO

   If YES, in which county do you reside? _____

   If NO, in which other state or country do you reside? _____

6. Survey information (filled in by surveyor):

   Data Collector/Surveyor

   Station Name/Location (SWIMS ID)

   Monitoring Date  Start Time

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## Appendix F. 2015 – 2018 Volunteer Aesthetic Monitoring Program Data Sheet and Scoring Key

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# Volunteer Aesthetics Monitoring Data Sheet Scoring Key

**Please answer all questions on the datasheet completely and to the best of your ability.**
**DNR cannot use incomplete data sheets in station data analysis.**

**If you have questions or to return this survey, please contact <insert contractor's name and contact info>**

*Form revision date: 02/11/15*

| | | | |
|---|---|---|---|
| **1. Your name:** | | **2. Station name:** | |
| **3. Monitoring date:** | m m / d d / y y | **4. Start time (include AM/PM):** | |
| **5. Water conditions:** | Calm | Slight movement | Moderate flow or waves | Rough or fast flowing |
| **6. Water level:** | High | Normal | Low |

*Overall aesthetic impression of site*

**7. Overall, how aesthetically pleasing do you find the site?**

Circle one of the following:

| **Very pleasing (0)** | **Somewhat pleasing (1)** | **Neither pleasing nor displeasing (2)** | **Somewhat displeasing (3)** | **Very displeasing (4)** |
|---|---|---|---|---|

Please describe. List any factors that make it pleasing or not pleasing.

*Objectionable deposits in/characteristics of the water*

**8a. Is the color or clarity of the water unattractive?**

| **Yes** | **No** |
|---|---|

If yes, please describe:

**8b. If yes to 8a, does the unattractive water color or clarity prevent you from accessing, enjoying, or using the water?**

| **Yes (1)** | **No (0)** |
|---|---|

**9. Please describe the characteristics of the water during this particular visit.**

| | | | | | |
|---|---|---|---|---|---|
| **A. Water Color:** | Colorless | Red | Green | Brown | Other (please indicate)_____ |
| **B. Water Clarity:** | Completely clear | Fairly clear | Fairly cloudy | Completely cloudy | |
| **C. Water Surface:** (Choose all that apply) | Normal | Oily sheen | Foamy | Floating aquatic plants | |
| | Natural debris | Neon green sheen | Other (please indicate)_____ | | |

**10a. Is there floating or submerged garbage present in the water?**

| **Yes** | **No** |
|---|---|

If yes, circle visible item(s):

| | | | |
|---|---|---|---|
| Building materials | Medical items | Household waste | Sewage-related litter |
| Food-related litter | Fishing-related litter | Other (please indicate)_____ | |

**10b. If yes to 10a, does the garbage in the water prevent you from accessing, enjoying, or using the water?**

| **Yes (1)** | **No (0)** |
|---|---|

**11a. Are any other substances present in the water that are not specifically mentioned on this form?**

| **Yes** | **No** |
|---|---|

If yes, list what:

**11b. If yes to 11a, do these other substances in the water prevent you from accessing, enjoying, or using the water?**

| **Yes (1)** | **No (0)** |
|---|---|

**12a. Is there garbage along the shoreline?**

| | Yes | No |
|---|---|---|
| If yes, circle type(s): | | |

Building materials | Medical items | Household waste | Sewage-related litter

Food-related litter | Fishing-related litter | Other (please indicate)_____

**12b. If yes to 12a, does the shoreline garbage prevent you from accessing, enjoying, or using the water?**

| Yes (1) | No (0) |
|---|---|

**13a. Along the shoreline, are there problem animals or problems caused by animals?**

| | Yes | No |
|---|---|---|
| If yes, list type(s): | | |

**13b. If yes to 13a, do these animal-related problems prevent you from accessing, enjoying, or using the water?**

| Yes (1) | No (0) |
|---|---|

**14a. Is there nuisance vegetation along the shoreline?**

| | Yes | No |
|---|---|---|
| If yes, list type and amount if known: | | |

**14b. If yes to 14a, does this nuisance vegetation prevent you from accessing, enjoying, or using the water?**

| | Yes (1) | No (0) |
|---|---|---|
| If yes, list type(s): | | |

**15a. Are there any other shoreline substances that are not specifically mentioned on this form ?**

| | Yes | No |
|---|---|---|
| If yes, please type(s): | | |

**15b. Do these other shoreline substances prevent you from accessing, enjoying, or using the water?**

| Yes (1) | No (0) |
|---|---|

*Objectionable deposits on the shoreline*

| | | |
|---|---|---|
| **16.** Have you previously evaluated this station? | Yes | No |
| If you have previously evaluated this station, what changes if any have you noticed in the aesthetic quality of the water or along the shoreline since your last visit? | | |
| Comments: Please include anything else you thought should be reported while completing this survey. | | |

*Additional feedback*

**17. END TIME:**

**For volunteer coordinator/DNR use only**

| | | |
|---|---|---|
| **Date the data sheet was reviewed by <contractor>:** | | **Check box if data sheet meets quality control requirements** ☐ |
| **Aesthetic impression score (for DNR use only):** | | |
| **Assessment score (for DNR use only):** | | |

*QA/QC*

## Appendix G. Responsiveness Summary for BUI Removal Target Revision and BUI Removal Recommendation Public Comment Periods

Below is a summary of comments received during the public notice period for the 2019 RAP Update, BUI Removal Target Revision Memo, and anticipated removal of the Degradation of Aesthetics BUI Removal Target for the Lower Green Bay & Fox River AOC. Thank you to those who took time to provide thoughtful comments during these periods.

1. BUI Removal Target Revision:
    a. Received via email following 2019 RAP Update meeting held on 5/7/2020 via Zoom by B. Kupsky in which a recommended target revision was presented:

**Comment:**

**5/7/2021:** *I recommend leaving the TMDL language in this BUI. I realize that it will be difficult, and will take a long time to demonstrate compliance with this endpoint. But monitoring results in the AOC have traditionally shown us that they are highly variable, making it difficult to identify long term trends with any degree of statistical confidence. Using the TMDL goals for the BUI would ensure that "real" compliance with the BUI removal criteria had been met.*

**Response:** WDNR and USEPA determined that the AOC program is not intended to overlap existing regulatory or permit compliance functions. Section 303(d) of the Clean Water Act authorizes USEPA to require states to develop lists of impaired waters and assist in the development of TMDLs which establish a maximum amount of pollutant allowed to be discharged to impaired waterbodies. TMDLs allow the states to control point sources through NPDES (WPDES) and MS4 permits and manage nonpoint source runoff through voluntary programs.

    b. Received via email during public comment period noticed via WDNR GovDelivery for the Degradation of Aesthetics BUI Removal Target Revision Memo:

**Comments:**

**11/19/2020**: *The proposed target revision looks good.*

**12/7/2020**: *I'm ok with the changes because the new objective focuses more directly on aesthetics rather than other issues. Having said that, given how green the river was this year with large deposits of algae on the shoreline I'm not sure that you meet the proposed target.*

**Response:** The revised target specific that monitoring and/or survey data from any 5-year period be used to evaluate if the BUI removal target was met. Survey data was collected from 2011-2013 and from 2015-2018, with 2011-2012 and 2015-2018 data used to evaluate the BUI status.

2. BUI Removal Recommendation:
    a. Received via email during public comment period noticed via WDNR GovDelivery for the Degradation of Aesthetics BUI Removal Recommendation Package:

# CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: 12 October 2021

TO: Office of Great Waters, OG/3

FROM: Ben Beardmore, Analysis Services, EA/7

SUBJECT: Beneficial Use Impairment: Degradation of Aesthetics – GB data analysis added to MKE

In July 2021, the Office of Great Waters asked the Analysis Services Section to review and address some methodological concerns raised by external reviewers of the draft *Lower Green Bay and Fox River Area of Concern Beneficial Use Impairment Removal Recommendation*. While the reviewers' concerns were directed toward the Lower Green Bay and Fox River Area of Concern (AOC), the same methodology was also applied in the Milwaukee River AOC. This memo responds to the request and presents additional analyses of datasets collected for both the Green Bay (GB) and Milwaukee (MKE) AOCs to address the reviewers' concerns.

The concerns raised by reviewers included the following:

1. Appropriateness of the questions used in the evaluation rubric. Concerns center on ambiguous language (e.g., "use the water") and questions that include multiple elements for interpretation ("make the area unpleasant *or* block your ability to access *or* use the water"), which make interpretation of results difficult at best. Another issue of concern is that the questions target the aesthetics of conditions of the public access site rather than the conditions of the water in which the beneficial use impairment (BUI) is designated.
2. The potential for observers to become habituated to degraded conditions. Even if the survey represents a random sample of observers, if those observers have been desensitized from long-term observation to degraded conditions, then any slight improvement may bias the perception of the observer.
3. Appropriateness of setting a threshold for each element at a level where it "prevent(s) you from accessing, enjoying, or using the water." The concern was raised that preventing use of the water would require a strong enough aversion to provoke an all or none response rather than simply a diminishment of enjoyment.
4. Appropriateness of relying on averages to meet thresholds of impairment. Relying on averages would require the offending element to be frequently present at many locations and on many occasions. This concern centers on setting thresholds that make it unlikely for an AOC to be classified as not meeting the "Aesthetics" beneficial use.
5. Appropriateness of setting a threshold for observations of a single objectionable element of greater than 75%. Concerns were raised that objectionable conditions are conceivably additive. For example, dates in which water clarity is poor may not coincide with dates where shoreline garbage is present, i.e. the objectionable condition may vary from date to date resulting in an objectionable state more frequently than any single condition occurs.

## Assessment of Concerns Raised

### Concern 1

The first concern can be addressed simply by stating that the evaluation rubric was not designed to be so granular as to differentiate among uses, nor to separate impairments to access, use, and enjoyment. In this case, the inclusion of multiple elements for evaluation in the question sought to broaden the applicability to ensure relevance to all observers. Rather than constraining the question to "users" of the resource, this wording also allows for "access" and "enjoyment." Regardless, concerns about question wording is somewhat moot, as the data have been collected. While the reviewers' concerns that the focus of the rubric was on aesthetics rather than the

underlying conditions of impairment are relevant to the overall decision regarding the removal of the beneficial use impairment, this concern is beyond the scope of this particular evaluation, which focuses only on the aesthetic aspect of the issue.

### Concern 2

The concern that a slight improvement may bias aesthetic impressions of a habituated observer is not clear. It appears that it may center on the likelihood of an observer increasing their aesthetic impression rating disproportionate to the magnitude of the improvement in conditions. If this is interpretation of the concern is correct, it may simply reflect a concern that observer judgements of what constitutes only a "slight" improvement may differ from that of the reviewer. That said, habituation to conditions may indeed affect the aesthetic impression ratings of observers. This concern, however, centers on the absolute value of the ratings. For example, an observer who becomes accustomed to a "Very displeasing" condition over time may rate it at a higher level despite no objective measure of improvement. As such, a statistical model that focuses on relative rather than absolute effects of objectionable substances on aesthetic ratings would address this concern.

### Concern 3

Setting a threshold that requires individual objectionable substances to a level where it "prevent(s) you from accessing, enjoying, or using the water," rather than simply being present, is ultimately a matter of judgement. That said, a statistical model that assesses the effect of an objectionable substances' absence, mere presence, or presence at a level where it prevents access, use or enjoyment, would allow decision-makers to evaluate and set thresholds at levels showing substantive effects on aesthetic ratings.

### Concern 4

Reliance on average scores or conditions when setting thresholds of impairment is a valid concern. Averages (means, modes, or medians) are statistical measures of central tendency and do not very well account for extreme values. Thus, if an objectionable substance is rarely present at a level that meets the threshold for impairment, but when it is, the impairment is extreme, the average score for that substance may not be high enough to identify it as a problem. That said, thresholds of aesthetic impression based on average ratings are more likely to reflect observers' perceptions as a whole. Understanding the relationship between objectionable substance presence and aesthetic impression would allow decision-makers to target efforts to address underlying conditions of aesthetic impairment.

### Concern 5

The fifth concern centers on the possibility of objectionable substances having an interactive effect on aesthetic impression ratings. In other words, the combined effect of two (or more) substances being present at the same time may be greater than the sum of their individual effects. This concern may also be addressed through additional analysis of the data.

Concerns two through five warrant additional analysis focused on identifying determinants of aesthetic impression ratings. The remainder of this memo presents the analyses conducted and provides results for both the Lower Green Bay and Fox River AOC and Milwaukee River AOC .

## Methods

To assess the importance of drivers of aesthetic impressions, I conducted a series of Adjacent Categories Ordinal Logit regression analyses (Agresti, 1989) in which the dependent variable, aesthetic impression rating, was predicted by variables identified from the observation card. Of note is that no single model addresses all reviewer concerns, as parameters become confounded by correlations among potential dependent variables as the number of parameters increases. Nevertheless, these types of models are useful for addressing the concern about the reliance on average threshold values, because the parameters provide measures of the relative contribution of each

element to a rating score, allowing one to assess the extent to which that element would improve (or reduce) the aesthetic quality depending on its starting conditions. This focus on how ratings change relative to a baseline addresses concerns about observer habituation to a particular condition by deprecating the absolute value of the rating. In other words, the focus of the model is on the change in the distribution of aesthetic impression ratings in response to a change in site conditions. Furthermore, the inclusion of all observers as repeated measures addresses collinearities associated with observations by a single individual. In other words, multiple ratings by the same individual are not treated as independent from one another.

### Model 1

The first analysis focused on the issue of reliance on setting thresholds for each element at a level where it "prevent(s) you from accessing, enjoying, or using the water." For this model, I included all available dependent variables as main effects. In so doing, this model accounts for variation in aesthetic ratings that can be attributed to elements that may be beyond the scope of efforts to address aesthetic impairments, such as the effects of water level, the qualities of a particular station, or whether the station had been previously evaluated by an observer.

Most attributes were entered into the model as categorical variables to provide precise point estimates rather than linear approximations. Within each attribute, all parameters are centered around a mean of zero, such that negative values indicate levels that contribute to more displeasing ratings while positive values contribute to more pleasing ratings, all else being equal (Bech and Gyrd-Hansen, 2005).

This model produced separate sets of parameters for the two AOCs; however, these parameters were jointly estimated to allow comparisons across the two AOCs.

### Model 2

A second model was developed to focus on the issue of interactions among objectionable substances to assess the implications of these additive effects on the appropriateness of setting a threshold for observations of any single objectionable element of greater than 75%. For this model, the scores established in the BUI removal recommendation were used as predictors of aesthetic impression rating. In other words, if an objectionable substance was found to prevent access, use or enjoyment, it was coded as one, otherwise zero. In addition to these threshold levels, the model also included additional parameters to capture the linear quadratic effect of the number of concurrent substances at threshold levels. Rather than treating each AOC separately, this model included two-way interactions with the Green Bay AOC in addition to the main effects described above. These interaction effects quantify differences in how attributes affect aesthetic impression ratings in the Green Bay AOC compared to the Milwaukee AOC. Initial model runs included all such interactions, with subsequent models eliminating interaction terms that were not statistically significant ($p>0.05$).

## Model Results

### Model 1

Model parameters are given in Table 1, and the effect of each attribute was considered statistically significant at $p<0.05$. The model constants showed different trends for the Milwaukee AOC compared to the Green Bay AOC. For Milwaukee, the constants trended towards positive values for higher (more pleasing) ratings, which indicate that all else being equal, observers tended to favorably rate their aesthetic impressions, and that the conditions described by other parameters in the model tended to decrease aesthetic ratings. For Green Bay, on the other hand, extreme ratings had negative parameter estimates, suggesting some reluctance on the part of observers to select these values. This result highlights an issue of non-extreme response bias (Liu et al., 2017). In other words, observers tended to avoid the "very displeasing" or "very pleasing" rating levels to a certain extent even with other factors accounted for. This bias may therefore reduce the likelihood of an impaired site meeting a threshold based on those ratings.

The effect of place on aesthetic impression was limited to the separate estimations of parameters for each AOC. Observation station was not included in this model despite the known place dependence of aesthetic impressions, because the focus of the model was to compare across the two AOCs rather than within an AOC. The mean effects of the stations were therefore not explicitly captured but influenced the values of the model constants.

The effect of time on aesthetic ratings was included as a linear term, coded as the number of decimal years since the first observation for the AOC; however, in both AOCs, this parameter was not found to be statistically significant (Table 1). In other words, **the effect of time on observations was minimal**. That said, time is correlated to some extent with another variable in the model, namely whether the observer had previously evaluated the station. For both AOCs, stations tended to be more positively rated when the observer had evaluated it previously ($p=0.025$), though no significant differences were found between the two AOCs (see the Wald (=) statistic and associated p-value in Table 1). This result suggests that observer habituation to the conditions of a site did occur; but the issue was addressed by accounting for its effect in the model.

Other attributes were also included in the model to account for their effect on aesthetic impressions despite being beyond the scope of any management effort. Parameters for water level, flow rate, observed color, and observed clarity had statistically significant effects on aesthetic ratings, but only clarity had effects that differed significantly between the AOCs. All else being equal, higher and faster flowing waters were associated with more pleasing ratings (Table 1). The effects of color on aesthetic impression were statistically significant, and appeared to trend differently between the two AOCs, large standard errors associated with these estimates, render these differences statistically insignificant. Water clarity, on the other hand, was found to differ in its effect on aesthetic impression between the two AOCs. In Milwaukee, this effect was largely linear, with increased clarity associated with more positive impressions. In Green Bay, water clarity was much less important, with cloudy conditions having a largely neutral effect on aesthetic rating, while somewhat clear conditions improved aesthetic impression ratings more than very clear conditions.

Having accounted for these additional influences on aesthetic impressions, the remaining attributes focus on the presence of objectionable substances recorded during the observers' evaluations. These latter attributes were recoded as categorical variables having three levels, based on being (1) absent, (2) present but not preventing access, use, or enjoyment, or (3) present and preventing access, use, or enjoyment. Parameter estimates can be found in Table 1, and as expected, as the magnitude of the presence category increased, so did the negative effect on aesthetic impression. These trends were consistent for both AOCs. **All objectionable substances except nuisance vegetation were found to have statistically significant effects on aesthetic impression scores. Differences in the effect sizes between AOCs were only apparent for Floating/Submerged Garbage and Animal-related problems, both of which were more important factors in the Milwaukee AOC than they were in the Lower Green Bay AOC. Nuisance vegetation did not meet the criterion for statistical significance in either AOC.**

One concern raised by reviewers was the reliance on presence of objectionable substances at a level that prevents access, use, or enjoyment, where the mere presence of an objectionable substance may result in aesthetic impairment. Figure 1 provides a visual on the relative difference in the effect of that threshold on aesthetic impression compared to the effects of simple presence of the substance or its absence. **The model does not suggest there is a "right" threshold, but illustrates that in many cases, there is no significant difference between the presence of an objectionable substance at levels that do not prevent access, use, or enjoyment and the absence of the substance.** A few exceptions to this finding, however, do exist. In Milwaukee, the presence of garbage (either floating/submerged or on the shoreline) significantly detracts from the aesthetic impression rating relative to its absence. In Green Bay, the garbage on the shoreline similarly detracts from the aesthetic impression through its mere presence; but the presence of garbage in the water does not. As noted above, nuisance vegetation shows no significant differences among the three levels for either AOC.

**Table 1:** Ordinal logit model to predict aesthetic impression rating ($R^2$=0.57)

| | | MILWAUKEE | | GREEN BAY | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Attribute** | **Level** | **β** | **s.e.** | **β** | **s.e.** | **Wald** | **P** | **W (=)** | **P (=)** |
| Constants | Very Displeasing | -2.098 | 0.425 | -0.906 | 1.302 | 384.0 | 0.000 | 3.2 | 0.530 |
| | Somewhat Displeasing | 0.025 | 0.224 | 0.548 | 0.657 | | | | |
| | Neither Pleasing nor Displeasing | 0.22 | 0.218 | 0.083 | -0.031 | 0.137 | | | |
| | Somewhat Pleasing | 1.274 | 0.217 | 0.794 | 0.652 | | | | |
| | Very Pleasing | 0.581 | 0.416 | -0.406 | 1.297 | | | | |
| Time | Linear per year | -0.035 | 0.040 | 0.101 | 0.053 | 4.4 | 0.110 | 4.2 | 0.040 |
| Water Level | Low | -0.144 | 0.061 | 0.043 | 0.100 | 15.1 | 0.005 | 3.5 | 0.170 |
| | Normal | -0.047 | 0.048 | -0.187 | 0.077 | | | | |
| | High | 0.191 | 0.067 | 0.144 | 0.091 | | | | |
| Flow | Not completed | -0.189 | 0.195 | -0.395 | 0.398 | 24.4 | 0.002 | 7.5 | 0.110 |
| | Calm | -0.178 | 0.080 | 0.052 | 0.158 | | | | |
| | Slight Movement | -0.049 | 0.070 | -0.126 | 0.133 | | | | |
| | Moderate Flow | 0.099 | 0.079 | -0.141 | 0.138 | | | | |
| | Fast Flowing | 0.317 | 0.132 | 0.611 | 0.217 | | | | |
| Color | Brown | 0.145 | 0.373 | -0.820 | 2.587 | 23.2 | 0.003 | 7.6 | 0.110 |
| | Brown-Green | -0.528 | 0.159 | 0.013 | 0.640 | | | | |
| | Colorless | -0.451 | 0.177 | 0.169 | 0.657 | | | | |
| | Green | 1.059 | 0.536 | 0.656 | 0.808 | | | | |
| | Other | -0.225 | 0.161 | -0.019 | 0.639 | | | | |
| Clarity | Completely Cloudy | -0.420 | 0.081 | 0.026 | 0.132 | 44.6 | 0.000 | 11.4 | 0.010 |
| | Fairly Cloudy | -0.416 | 0.077 | -0.032 | 0.113 | | | | |
| | Fairly Clear | 0.078 | 0.086 | 0.101 | 0.137 | | | | |
| | Completely Clear | 0.759 | 0.184 | -0.096 | 0.262 | | | | |
| Color or Clarity Problem | Not Present | 0.200 | 0.050 | 0.335 | 0.085 | 53.6 | 0.000 | 3.4 | 0.180 |
| | Present | 0.135 | 0.069 | -0.062 | 0.088 | | | | |
| | Prevents use/enjoyment | -0.335 | 0.063 | -0.273 | 0.085 | | | | |
| Floating/Submerged Garbage | Not Present | 0.441 | 0.051 | 0.179 | 0.090 | 80.4 | 0.000 | 6.7 | 0.034 |
| | Present | 0.064 | 0.053 | 0.021 | 0.103 | | | | |
| | Prevents use/enjoyment | -0.505 | 0.072 | -0.200 | 0.129 | | | | |
| Other Substance in Water | Not Present | 0.112 | 0.077 | 0.067 | 0.099 | 10.1 | 0.038 | 0.1 | 0.930 |
| | Present | 0.214 | 0.089 | 0.241 | 0.147 | | | | |
| | Prevents use/enjoyment | -0.326 | 0.139 | -0.308 | 0.153 | | | | |
| Garbage on Shoreline | Not Present | 0.254 | 0.050 | 0.417 | 0.087 | 52.1 | 0.000 | 3.4 | 0.180 |
| | Present | -0.050 | 0.050 | -0.014 | 0.072 | | | | |
| | Prevents use/enjoyment | -0.204 | 0.069 | -0.404 | 0.092 | | | | |
| Animal-related Problem | Not Present | 0.285 | 0.071 | -0.084 | 0.087 | 17.1 | 0.002 | 10.8 | 0.005 |
| | Present | 0.057 | 0.088 | 0.085 | 0.112 | | | | |
| | Prevents use/enjoyment | -0.341 | 0.121 | -0.001 | 0.121 | | | | |
| Nuisance Vegetation | Not Present | 0.095 | 0.059 | 0.140 | 0.077 | 7.5 | 0.110 | 0.9 | 0.650 |
| | Present | -0.068 | 0.071 | 0.015 | 0.089 | | | | |
| | Prevents use/enjoyment | -0.026 | 0.096 | -0.156 | 0.102 | | | | |
| Other Substance on Shoreline | Not Present | 0.156 | 0.064 | 0.068 | 0.106 | 12.0 | 0.017 | 0.9 | 0.640 |
| | Present | 0.097 | 0.080 | 0.252 | 0.164 | | | | |
| | Prevents use/enjoyment | -0.254 | 0.108 | -0.320 | 0.143 | | | | |
| Previous Evaluation | Not previously evaluated | -0.096 | 0.036 | -0.042 | 0.079 | 7.5 | 0.024 | 0.4 | 0.540 |
| | Previously evaluated | 0.10 | 0.04 | 0.04 | 0.08 | | | | |

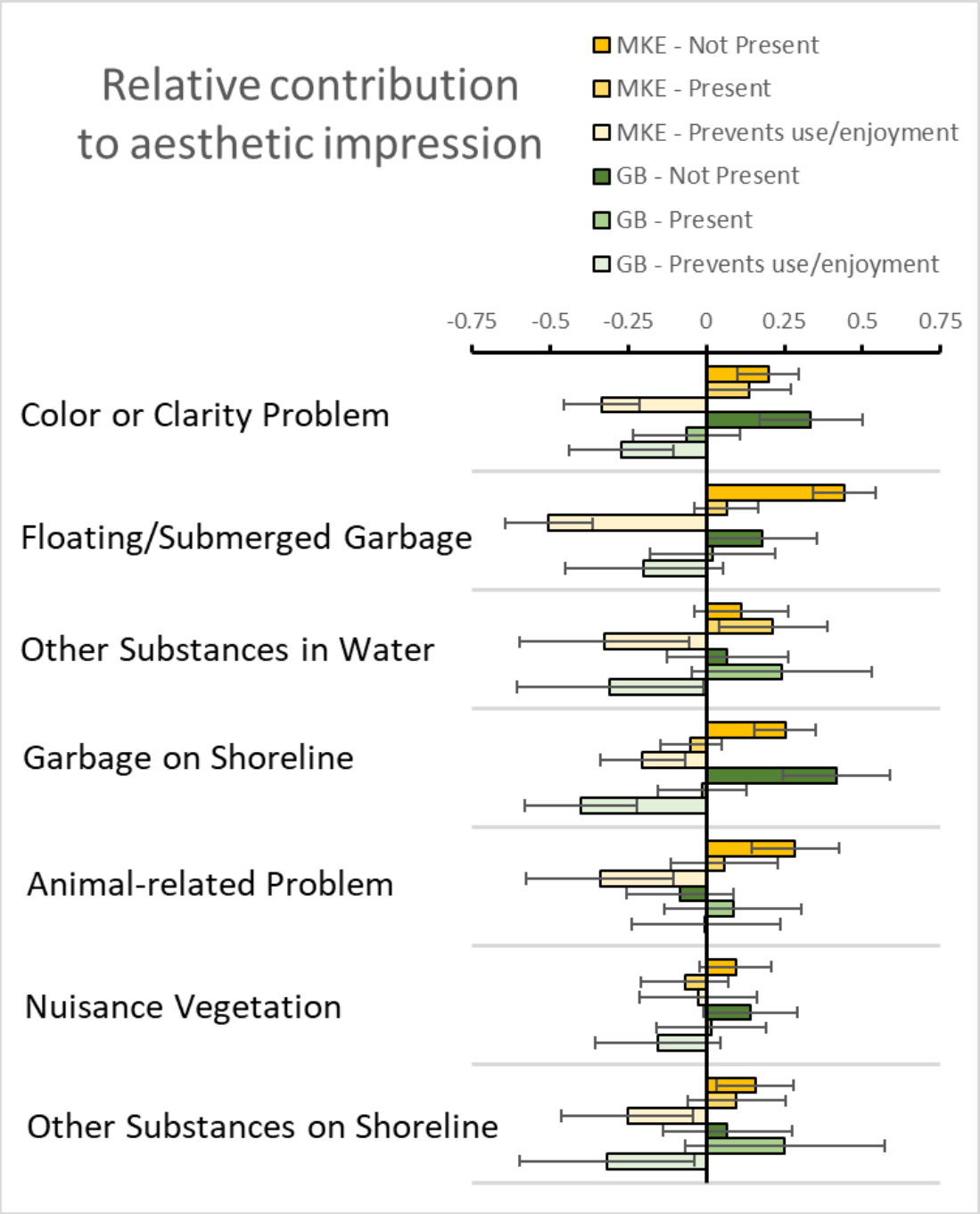


**Figure 1:** Model parameters for objectionable substances showing relative contributions of each level to aesthetic impression score. Error bars represent the 95% confidence interval around each model estimate.

Of direct relevance to establishing the thresholds for consideration to remove the impaired status is the weight applied to each of the objectionable substances listed. The model highlights that some substances are more important than others when considering aesthetic quality. Based on the range of parameter values within each substance, the relative importance of each attribute can be calculated. The importance score is a simplified measure of the contribution that an attribute makes to the aesthetic rating across the range of values for which it is

observed (Table 2). When considering the full model, one can see that 31 percent of an observed aesthetic rating can be attributed to the model constants in Milwaukee, whereas the model constants contributes 20 percent in Green Bay. Other statistically significant attributes ranging in their contributions from one percent to 17 percent. If focusing only on the listed objectionable substances, these values can be rescaled by redistributing the proportion of the total importance attributable to them, so they sum to 100 percent as presented in the two righthand columns of Table 2. **These finding suggest that garbage in the water among the objectionable substances listed is the biggest driver of aesthetic impairment in the Milwaukee AOC, while in the Green Bay AOC, shoreline garbage is the most important. These importance scores suggest that focusing on certain drivers rather than giving equal weight to each of the identified issues would improve the efficiency of efforts targeting the removal of the BUI, but that these drivers are not universally important across AOCs.**

**Table 2:** Relative importance of Model 1 attributes to aesthetic impression rating.

| | Relative Importance | | Objectionable Substances | |
|---|---|---|---|---|
| | MKE | GB | MKE | GB |
| Constants | 31% | 20% | | |
| Previous Evaluation | 2% | 1% | | |
| Time | 1% | 4% | | |
| Water Level | 3% | 4% | | |
| Flow | 5% | 12% | | |
| Color | 14% | 17% | | |
| Clarity | 11% | 2% | | |
| Water color/clarity problem | 5% | 7% | 15% | 18% |
| Floating/Submerged garbage | 9% | 4% | 26% | 11% |
| Other substances in water | 5% | 6% | 15% | 16% |
| Shoreline garbage | 4% | 10% | 12% | 24% |
| Animal-related problems | 6% | 2% | 17% | 5% |
| Nuisance vegetation | 1% | 3% | 4% | 9% |
| Other shoreline substances | 4% | 7% | 11% | 17% |

## Model 2

This simplified model, while not accounting for as many influences as the previous one, highlights the importance of the combined effects of multiple objective substances present at once. Table 3 illustrates these results. Figure 2 plots the linear quadratic utility function for the total score for both AOCs and illustrates the relative difference in the importance of the total number of substances between the two AOCs. Whereas the Milwaukee AOC observers tended to place emphasis on the number of objectionable substances, with utility value range of ±1.5 around zero, the number of substances was much less important to observers' evaluations in the Green Bay AOC, with utility value range ±0.26 around zero. In other words, **the effects of two or more objectionable substances at levels preventing access, use, or enjoyment was much greater than the sum of their individual effects** in Milwaukee and in Green Bay. emphasized the additive effects of each individual substance.

The shapes of these curves also highlight a difference between the two AOCs. In the Milwaukee AOC, the concave shape of the curve indicates that aesthetic improvement increases more dramatically with each additional substance that is removed. In other words, all else being equal, placing an emphasis on reducing occurrences where multiple objectionable substances are observed would substantially improve aesthetic impressions. That said, there is no number of substances within the available range that offers a clear point of optimality above zero. **Therefore, the greatest improvements to the aesthetic quality of a site occurs when the number of co-occurring issues in the Milwaukee AOC is reduced to zero.**

In contrast, the curve for the Green Bay AOC and has a small negative slope and is slightly convex, indicating that the interaction effect diminishes as the total number of substances declines relative to the effect of each specific substance.

These analyses do not assess whether 75 percent is an appropriate threshold. It does, however, provide information about the effect of additional substances on aesthetic impression, and thresholds may be set for individual substances at levels that reduce the likelihood of co-occurrence with other substances.

**Table 3:** Ordinal logit model to predict aesthetic impression rating ($R^2$=0.65)

| | Attributes | Beta | s.e. | Wald | p-value | Relative Importance |
|---|---|---|---|---|---|---|
| Constants | Very Displeasing | -4.05 | 0.19 | 652.8 | 0.000 | 15.5% |
| | Somewhat Displeasing | -0.85 | 0.08 | | | |
| | Neither Pleasing nor Displeasing | 0.34 | 0.07 | | | |
| | Somewhat Pleasing | 2.31 | 0.09 | | | |
| | Very Pleasing | 2.24 | 0.11 | | | |
| City | GB | -0.59 | 0.05 | 124.8 | 0.000 | 2.9% |
| | MKE | 0.59 | 0.05 | | | |
| Prevents access, use or enjoyment | Water color/clarity | -0.62 | 0.09 | 50.9 | 0.000 | 1.5% |
| | Floating/Submerged garbage | -0.14 | 0.10 | 1.9 | 0.160 | 0.4% |
| | Other substances in water | -0.26 | 0.15 | 2.8 | 0.097 | 0.6% |
| | Shoreline garbage | 0.49 | 0.12 | 16.9 | 0.000 | 1.2% |
| | Animal-related problems | 0.28 | 0.13 | 4.4 | 0.036 | 0.7% |
| | Nuisance vegetation | 0.58 | 0.15 | 14.9 | 0.000 | 1.4% |
| | Other shoreline substances | 0.63 | 0.17 | 13.6 | 0.000 | 1.5% |
| Total number of objectionable substances present | Total Score | -1.24 | 0.08 | 251.3 | 0.000 | 24.1% |
| | Total Score SQ | 0.09 | 0.01 | 40.8 | 0.000 | 14.7% |
| Statistically significant interaction effects | Green Bay X Shoreline garbage | -1.12 | 0.18 | 38.3 | 0.000 | 2.7% |
| | Green Bay X Nuisance vegetation | -0.98 | 0.21 | 20.8 | 0.000 | 2.4% |
| | Green Bay X Other shoreline substances | -0.78 | 0.25 | 9.7 | 0.002 | 1.9% |
| | Green Bay X Total Score | 1.30 | 0.16 | 69.1 | 0.000 | 18.9% |
| | Green Bay X Total Score SQ | -0.11 | 0.04 | 7.9 | 0.005 | 9.6% |

## Conclusions

Reviewers raised five main concerns about the *Green Bay and Lower Fox River Area of Concern Beneficial Use Impairment Removal Recommendation*. The first concern centered on the questions included in the assessment form used by volunteer observers to evaluate the aesthetic conditions of each site. Overall, this concern reflects reviewers' desires for greater specificity in the constructs assessed by each question, and in so doing, broadening the scope of the assessment beyond aesthetic aspects of the impairment designation. Ultimately, however, this concern is moot for two reasons. The first reason is that the form is fit for its intended use (i.e., for volunteer assessments of aesthetic impressions). The second is that the form provided the only data with which to assess the aesthetic component of the AOC.

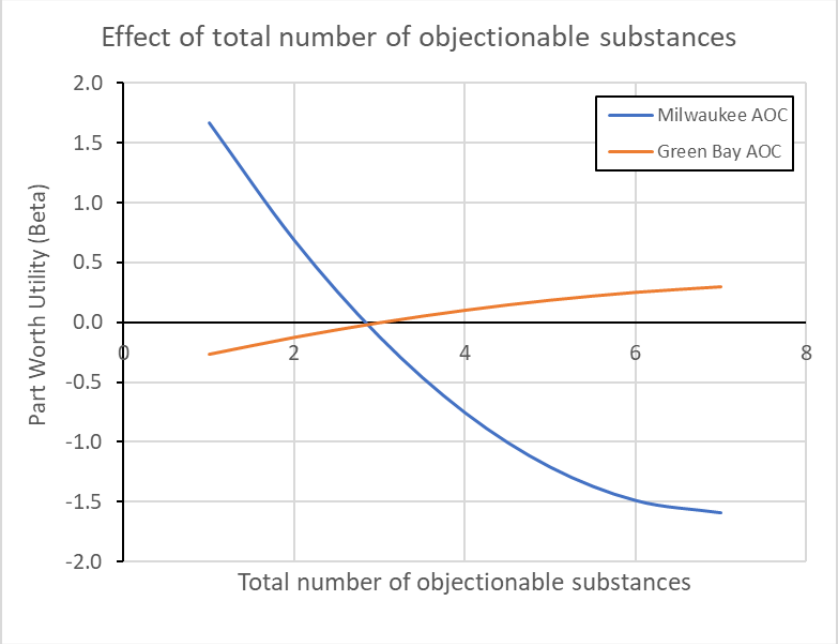


**Figure 2:** Point estimates of the relative contribution of the number of objectionable substances that co-occur at a site to aesthetic impression rating.

The remaining concerns speak to implied assumptions about how volunteer (and public) perceptions of aesthetic qualities were considered in setting criteria used to set thresholds for removal of the BUI. The models presented in this memo test most of these assumptions as follows:

1. Model 1 found that while observers may become habituated to degraded conditions, this effect can be isolated by inclusion of parameters reflecting the effects of time and an observer's previous evaluation of a site. All else being equal, observations where volunteers had previously evaluated the site received slightly, but statistically significantly, higher aesthetic impression ratings. The effect of habituation, however, is relatively small compared to the effects of the objectionable substances that form the metrics related to lifting the BUI.

2. Model 1 also found that, relative to its absence, an objectionable substance at levels that prevented access, use or enjoyment were most likely to significantly affect aesthetic impression. While in some cases, a substance's mere presence had a measurable effect relative to its absence, in other cases, no differences were found among all three levels. In fact, the model clearly demonstrates that objectionable substances differ in their importance to the aesthetic quality of a site.

   Model 1 also found differences in which objectionable substances were the most important drivers of aesthetic impressions. For the Milwaukee AOC, floating/submerged garbage was the objectionable substance that contributed most to aesthetic impression, whereas for the Green Bay AOC, shoreline garbage was most important. Some substances that were not statistically significant contributors in one AOC were important in the other. For example, nuisance vegetation failed to show a statistically significant effect on aesthetic impression for the Milwaukee AOC. For the Green Bay AOC, nuisance vegetation was statically significant. From these results, it seems that scoring impairments based on substances impairment (i.e., prevention of access, use, or enjoyment) is a reasonable, if simple, approach.

3. Model 2 demonstrated the nonlinear effect of multiple objectionable substances. As the number of substances present increases, their effects are not merely additive, but also interact to have a total effect that is greater than the sum of the individual effects, at least for the Milwaukee AOC. This model does not imply a specific threshold for the frequency of an objectionable substance being present to be considered a management concern, but further illustrates the uniqueness of each AOC and the importance of tailoring evaluations of aesthetic impressions to the different places.

# References


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Bech, M., & Gyrd-Hansen, D. (2005). Effects coding in discrete choice experiments. *Health Economics*, 14(10), 1079–1083. https://doi.org/10.1002/hec.984

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**Comments:**

**5/3/2021**: *I applaud the idea of further cleaning up the Fox River and Green Bay. The algae blooms, smelly air, coal piles, destruction of Atkinson Marsh are large problems to work on but the long term benefits of improving the area are worthwhile.*

**6/3/2021**: *Given that: "the Degradation of Aesthetics BUI was listed as confirmed due to total suspended solids and subsequent algal blooms causing frequent unnatural color and turbidity limiting recreational use and degrading aesthetic value of AOC waterbodies". Neither TSS nor nutrient loading to the bay have been significantly attenuated. Nor has the system remained at steady state. Since 2019 the National Centers for Coastal Ocean Science harmful algae bloom (HAB) monitoring system for Green Bay and Lake Winnebago has produced satellite images that show prolific and frequent blooms from summer through late fall. Cyanobacterial blooms appear to be increasing, and their presence has received significant attention. Coincidentally, a colleague was on the bay in the AOC yesterday (6/1/2021) and reported significant blooms already present this year, which is early.*

*In addition, using average values for aesthetics may obscure the picture. During 2015-2018 eight of the 12 stations exceeded the impression score of 3 (displeasing) at least once, and all but one station exceeded the impression score of 2 (neither pleasing nor displeasing) at least once and several stations exhibited an average value above 2 in at least one year (figure 14). Furthermore, to set the criteria at anything less than 75% of the surveys indicating objectionable substances impeding access, enjoyment or use, strikes me as an exceptionally low bar. In this case even averages are telling. Just eyeballing figure 16 would appear to indicate that objectionable conditions exist for most of these locations easily more than 10% of the time and in half of these stations objectionable conditions occur more than 20%. In addition, objectionable conditions are conceivably additive. For example, dates in which water clarity is poor may not coincide with dates where shoreline garbage is present, i.e. what is the objectionable condition may vary from date to date resulting in objectionable state more frequently in aggregate.*

*In this context it is worth questioning whether the BUI warrants lifting. Furthermore, I worry that removing the Aesthetic impairment designation with such a low threshold at this time will harm DNR's credibility for little gain.*

**6/3/2021**: *Beauty is in the eye of the beholder. Even if the survey represents, a random sample of observers, if those observers have been desensitized from long term observation to degraded conditions, then any slight improvement may bias the perception of the observer. In the end it is the factors that create the "degraded" conditions that count, and these have not shown a consistent downward trend. I agree with XXX's concern that this could negatively impact WDNR credibility.*

**6/4/2021**: *I agree that aesthetic conditions in the AOC have generally improved. However, given the severity of nuisance algal blooms recently, some that were somewhat alarming from a visual standpoint, I am not in favor of saying that Lower Fox River and Lower Bay waters "do not exhibit unacceptable levels…of…Materials producing color, odor, taste, or unsightliness… that impair use." I question whether the survey data appropriately supports removal of the BUI as well. I concur with others in suggesting that using a simple averaging approach to the Aesthetic Impression and*

*Assessment Scores analysis may not be appropriate given the structure of the questions. In addition, the >75% threshold for objectional substances to be unacceptable seems like a low bar to meet.*

**6/4/2021**: *This email is to provide comment on the proposal to remove the aesthetics BUI in the Lower Green Bay and Fox River AOC. Based on my review of the draft removal proposal I do not believe that the collected survey data justify the removal of this BUI. The primary sources for the 1987 impairment designation, Total Suspended Solids and blue-green algae, have not been attenuated to the extent necessary to justify an improvement of aesthetics of the AOC. I do not agree with the revised target and feel that it does not accurately set a meaningful and measurable target for removal of this BUI. If it is to be revised away from TSS and blue-green algae concentrations, the target should at a minimum consider the different uses impacted by aesthetics, such as viewing, fishing, motorized and non-motorized boating activities, paddle boarding, swimming, etc. The WDNR has looked at the aesthetic perceptions of water clarity in lakes in past studies (see Matthew Diebel).*

*In addition, the survey instrument used in data collection includes several flaws, including ambiguous language (e.g., "use the water") and quadruple-barreled questions ("make the area unpleasant or block your ability to access or use the water"), which make interpretation of results difficult at best. Furthermore, the questions target the aesthetics of conditions of the public access site rather than water quality in which the BUI is designated upon. Based on my expertise in social science and survey design, I do not believe that the survey provides the representative data needed to justify removal of this BUI.*

**6/4/2021**: *I have reviewed the proposal and have some specific concerns with the language and methodology of the survey. These are not minor considerations because these concerns greatly affect the validity of the survey, which in turn greatly influences the validity of the proposed decision to remove the Aesthetic Impairment.*

*Survey Language: Does the offending element need to be present to such a level that it "prevent(s) you from accessing, enjoying, or using the water"? Prevent is a fairly strong word. The wording of the questions seems to require a strong aversion to the water before someone would honestly respond YES to the item in question. Most of the questions in the 2015-18 survey were formulated like this example:*

*"8a.Is the color or clarity of the water unattractive?*

*8b. If yes to 8a, does the unattractive water color or clarity prevent you from accessing, enjoying, or using the water?"*

*The word "prevent" implies that conditions must be so unpleasant or inaccessible that one would not, or could not use the water resource. Someone might enjoy canoeing, duck hunting, fishing, etc, but be repelled by the item addressed in the question. They may enjoy the activity a lot less than if the offending aesthetic were not present, but it may not be so offensive as to prevent them from "accessing, enjoying, or using the water'. This form of question implies an all or none, or worse case response; whereas, an aesthetic impairment should be measured in degrees. That is, a far more appropriate alternative would be a range from no impact up to the worse case which prevents access, enjoyment or using the water.*

*Averaging Methodology of Survey:*

*I have serious concerns with the format of the survey questions, and how they are ranked based on an average. With the current survey questions (2015-18) and average methodology, I think our AOC could have easily "passed" with no impairment except for during some of the most objectionable periods in the last century.*

*It seems inappropriate to use averages without setting the frequency metric of number of "bad" occurrences fairly low. Does the offending element need to be so bad that it is present most of the time, throughout the survey season?*

*With averages, most of the offending elements need to be present at excessive levels for a particular site to be impaired (i.e. "prevent" language). With the current methodology of using averages, it seems that the offending elements need to be present: 1) at levels high enough to prevent access, enjoyment, or use, and 2) at most locations, and 3) a majority of the time for the AOC to be considered impaired for Aesthetics. This use of averaging, makes it almost prohibitively difficult for an AOC to warrant being classified as not meeting the Aesthetic beneficial use.*

*I'm thankful that many aesthetics have improved. However, are the algal blooms not an aesthetic impairment. What about the mounds of quagga mussel shells present on some portions of the east shore that are so bad they often block water and fish exchange at the outlets of many streams like Mahon. Note that I'm only thinking about the aesthetics, not the other issues related to blooms or invasive species.*

*In conclusion, removing the Aesthetic Beneficial Use Impairment is not warranted because the decision to remove this impairment is based on a survey instrument that is flawed. Please find a more appropriate survey instrument to apply to our AOC.*

**Response:** Please see the attached Correpondence/Memorandum dated 12 October 2021 for additional data analyses and responses to these comments.