



HEALING OUR RIVERS & HARBORS



Wisconsin's Great Lakes Areas of Concern.





Historical headlines warn of pollution hazards on Wisconsin rivers.

From burning rivers to fishable, swimmable waters

Cleaning up Great Lakes Areas of Concern in Wisconsin.

Kendra Axness

Imagine that it's Aug. 1, 1969 and you have just retrieved the latest *Time* magazine from your mailbox. Scanning the table of contents, you see that tucked below nine separate articles on the recent Apollo 11 moon landing is an article entitled, "America's Sewage System and the Price of Optimism." You find that the article describes the poor state of many major U.S. rivers, calling Ohio's Cuyahoga River "among the worst of them" and citing the now-infamous fire that "burned with such intensity that two railroad bridges spanning [the river] were nearly destroyed." The Cuyahoga, says the article, is a river that "oozes rather than flows."

If you had lived in one of Wisconsin's Great Lakes communities back then, you may have been able to share your own stories of troubled rivers. The Cuyahoga River, while known for the fire that inspired national action to clean up our waterways, was not the only river that burned. In 1951, following the flushing of 60,000 gallons of fuel oil into storm sewers from a broken oil company tank, Lincoln Creek in Milwaukee accidentally ignited.

Such river fires were just one symptom of unhealthy rivers. Residents of Superior living along the St. Louis River noticed grain dust in the air and taconite pellets on the beaches. Bay Beach along the southern shore of Green Bay, a popular swimming destination since the

1890s, closed in 1933 due to pollution from raw sewage, oil slicks and wastes from canning factories. In 1969, dredging of the Sheboygan River ceased due to heavy metals in the sediments which made it difficult and unsafe to handle the material and thus hindered the use of the harbor for shipping. Marinette residents saw raw sewage flowing in the river after rain events, evidence of the problems posed by an aging and overburdened sewer system.

The long history of development and industrialization in the United States led to these problems, and many partners have acted to address them. Nationally, the most significant step was Congress' bipartisan passage of the Clean Water Act in 1972, which established the goal of making the nation's waters fishable and swimmable.

Regionally, the Great Lakes Water Quality Agreement (first signed in 1972 and amended in 1978, 1987 and 2012) set the stage for bi-national cooperation between the United States and Canada in restoring the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem.

The initial focus of the 1972 Clean Water Act and the Great Lakes Water Quality Agreement was to establish better wastewater treatment infrastructure. As time went on, their focuses expanded to toxic pollutants that had been released into the rivers and harbors as the result



Researchers sample white suckers from the Sheboygan River for tumors and other abnormalities.

of past industrial practices. Areas with the most severe problems from these so-called "legacy pollutants" were identified in the 1987 Great Lakes Water Quality Agreement as "Areas of Concern" (AOCs) that required special attention for cleanup and restoration. The areas were designated primarily where state natural resource agencies knew of significant toxic pollution in river sediments. Many of the areas had also urbanized without consideration for the



JIM LUNDSTROM

Cleanup and restoration of Wisconsin's Areas of Concern will benefit a variety of fish and wildlife and improve our enjoyment of these valuable river and harbor resources.



DNR FILE

impacts of development on fish and wildlife.

Wisconsin has five Areas of Concern: the St. Louis River (shared with Minnesota), the Lower Menominee River (shared with Michigan), Lower Green Bay & Fox River, the Sheboygan River and the Milwaukee Estuary. These are economically, environmentally and culturally important areas. All have been significantly impaired by human activities, but each is unique in its particular environmental problems and need for repair. One issue common to all sites is toxic contamination of river and harbor sediment, and sediment cleanups are the foundation for addressing AOC problems.

Initial efforts in the late 1980s and 1990s focused on defining the problems and identifying actions to address them. Subsequently, the Wisconsin Department of Natural Resources and its partners began to carry out some of the actions. But cleanup is expensive, and resources were limited. Federal funding through the Great Lakes Restoration Initiative, which started in 2010, has provided a big boost to the program. This initiative has increased our ability to carry out scientific studies to understand past and current conditions and to do on-the-ground cleanup and restoration work in our AOCs (and in other degraded sites in the Great Lakes region).

Along with scientific data, commu-

nity stakeholder perspectives are an important consideration for developing Areas of Concern program goals and actions. There are many ways that citizens can become involved. Each AOC has a citizen advisory committee, watershed group, or newsletter network to keep the community informed of activities and provide opportunities for input. Other opportunities to help restore AOCs include river cleanups and citizen volunteer monitoring projects.

Although none of Wisconsin's AOCs have been delisted, there are many reasons to celebrate success. One of the most notable successes is a sediment cleanup on the Kinnickinnic River in the Milwaukee Estuary Area of Concern that resulted in the economic revitalization of a once-blighted stretch of the river.

The years 2011 and 2012 were historic for the Sheboygan River due to the investment of more than \$80 million for multiple dredging and habitat restoration projects. We can now say that all of the actions that were needed to address the known AOC problems have been carried out, and we can monitor the river's recovery in anticipation of removing the AOC designation.

Read on to learn about the work that is being done to improve these Areas of Concern waterways — the stories illuminate our history, demonstrate the pride we feel in our Great Lakes communities, and show hope for a future with clean water and healthier communities. •

Kendra Axness is the Policy and Outreach Coordinator for DNR's Office of the Great Lakes.

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Sediments contaminated by PCBs, heavy metals and other toxins can result in consumption advisories and impaired recreational uses.

For information about how to get involved in your AOC, contact Kendra Axness at (608) 267-0700 or visit dnr.wi.gov/ (search "areas of concern").

What does it mean to delist an Area of Concern?

The DNR's Great Lakes Program is responsible for cleaning up and restoring Wisconsin's Areas of Concern. The aim is to restore them to an acceptable level as defined by AOC-specific goals known as "delisting targets."

Once the goals have been achieved, the Area of Concern designation can be removed, or in other words the AOC can be "delisted." Delisting the AOCs will be cause for celebration. But more work to fully restore the areas may be needed after delisting to further improve the environment for fish, wildlife and people. It will be up to the local communities to set new goals and carry out more actions for each river.

Partnerships are essential for achieving Area of Concern restoration goals. It takes a team effort by many state and federal regulatory programs, municipal governments, nonprofit organizations, technical consultants and committed citizens to achieve the restoration of the beneficial uses. These same partners can continue working together to achieve further improvements in the future after delisting. •

Kendra Axness

What is a beneficial use impairment?

A "beneficial use" is any way that a water body can improve the quality of life for humans or for fish and wildlife. If the beneficial use is unavailable due to environmental problems, then that use is impaired. Each impaired beneficial use has its own AOC-specific restoration goal. Once all the goals for all the applicable beneficial use impairments have been met, the AOC can be delisted.

The U.S. and Canada have agreed upon a list of 14 possible beneficial use impairments (BUIs).

- Restrictions on fish and wildlife consumption
- Tainting of fish and wildlife flavor
- Degradation of fish and wildlife populations
- Fish tumors or other deformities
- Bird or animal deformities or reproductive problems
- Degradation of benthos
- Restrictions on dredging activities
- Eutrophication or undesirable algae
- Restrictions on drinking water consumption, or taste and odor problems
- Beach closings/recreational contact restrictions
- Degradation of aesthetics
- Added costs to agriculture or industry
- Degradation of phytoplankton and zooplankton populations
- Loss of fish and wildlife habitat

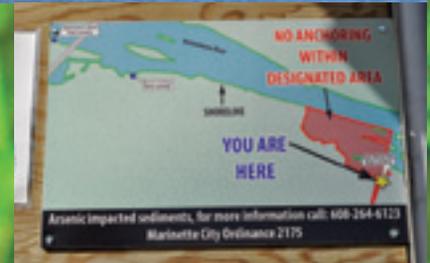
Each Wisconsin AOC has a subset of the 14 BUIs based on local conditions at the time of listing. •

Kendra Axness



REGGIE GAUGER

Contaminated sediment is dredged from the Sheboygan harbor.



JO TEMTE

Contaminated sediments impair many uses including boating.



Water birds can be harmed by contaminated sediments and habitat loss.

ROBERT O'QUEEN

What lives in the mud?

And why we care.

Benthic creatures — larval insects, worms, mussels and other invertebrates — make their living on and in the sediments of lakes and streams. While we may not find these lowly creatures appealing, fish, birds and other aquatic life find them delicious, and in fact, depend on them for their survival.

A healthy and diverse population of bottom-dwelling creatures, or benthos, is essential to a healthy aquatic ecosystem. Unfortunately, as we see in all five of our Areas of Concern (AOCs), these creatures are threatened by sedimentation (dirt and debris that wash into our waterways degrading the quality of benthic habitat) and toxic pollution, which the benthos take in as they feed.

Toxins affect the health and well-being not only of the benthos, but also the animals that eat them. As these creatures are consumed, many types of toxins found in sediments accumulate in fish, and then in larger fish and water birds. Eventually, some of these species — especially long-lived fish and waterfowl — can accumulate enough toxins to be potentially harmful to anglers and hunters who consume them. When enough toxin is present in fish or wildlife to be a health concern, the state issues consumption advisories to help protect public health.

Substantial progress has been made in cleaning up contaminated sediments in Wisconsin's AOCs, and natural processes can help reduce the effects of contamination on benthic communities over time.

The Department of Natural Resources and the U.S. Geological Survey, a federal agency that conducts water research, are working to evaluate benthic communities and toxin levels in creatures that eat them in Wisconsin's AOCs as well as other contaminated sites across the Great Lakes.

Since relatively little historic data is available to clarify the state of benthic communities when the AOCs were designated, these sites must be compared to "reference sites," that have similar characteristics but are relatively undamaged.

With this information, scientists gain important information about how the rivers and their inhabitants respond to sediment cleanup and habitat restoration projects. •

Andrew Fayram is DNR's Great Lakes Monitoring Coordinator.

A researcher holds a sampling of benthic invertebrates.



FRANK KOSHIERE

Researchers inspect a monitoring structure for benthic invertebrates.



DONALEA DINSMORE

Investing in a great idea and great resource

Wisconsin puts Great Lakes Restoration Initiative funds to work.

Natasha Kassulke

A world class resource like the Great Lakes deserves world class attention. To that end and in an effort to heal the Great Lakes from 150 years of abuse, the federal government is providing funds and Wisconsin is putting them to work on the ground.

Crucial to restoring the Great Lakes Basin is the Great Lakes Restoration Initiative (GLRI), the largest investment in the Great Lakes in two decades. The GLRI is a federal program that provides unprecedented funding for protection and restoration efforts on the five Great Lakes.

State and local governments and nonprofit organizations are eligible to receive grants from the U.S. Environmental Protection Agency (EPA) for projects addressing toxic substances; invasive species; nonpoint source pollution; habitat protection and restoration; or accountability, monitoring, evaluation, communication and partnership building.

The EPA has awarded nearly \$88 million in GLRI funds to more than 180 protection and restoration projects in Wisconsin.

Altogether, Congress allocated \$475 million in the first year of GLRI and an additional \$300 million in each of the following two years to support this effort. More recently, a proposal in Congress would permanently fund a law to continue efforts to revitalize the Great Lakes.

Already, tremendous efforts have been made in Wisconsin to clean up the lakes and protect them from further pollution, and governments at all levels have put millions of dollars to the task. Industries have chipped in to change production processes, modify products, and help clean up contaminated areas. Municipalities have upgraded sewage and water treatment facilities across the basin. Community and environmental groups have worked tirelessly to monitor progress and improve the environmental condition of the Great Lakes. The GLRI builds on these efforts.

The Great Lakes Restoration Initiative is working in Wisconsin to clean up and restore five Areas of Concern:

- St. Louis River
- Lower Menominee River
- Lower Green Bay and Fox River
- Sheboygan River
- Milwaukee Estuary

"When the five Areas of Concern in Wisconsin were first established, there was so much energy within the communities for creating plans and carrying out the needed actions,"

says Steve Galarneau, Director of the Office of the Great Lakes for the Department of Natural Resources. "But they bumped into high price tags for projects, preventing those plans from being implemented. Now, with the GLRI, we have both leadership and resources and it's amazing how much progress we are making. It is exciting and fulfilling to see those early plans coming to life."

Learn how communities, business and government have come together to give the Great Lakes a fighting chance at maintaining their world-class title and discover how GLRI funding for these projects has provided significant support to these efforts, helping Wisconsin move closer to achieving its goals for the Great Lakes.

For more information visit: glri.us/ •

Natasha Kassulke is the editor of Wisconsin Natural Resources magazine.

Wisconsin's Great Lakes Areas of Concern



DNR FILE

DNR FILE PHOTO



Historical logging practices damaged the St. Louis River.

CAROLE LENT



The Duluth-Superior harbor is the largest shipping port on the Great Lakes.



DNR FILE PHOTO

FRANK KOSHERE



Runoff brings sediments and pollutants into the Duluth-Superior harbor.

Healing the St. Louis River Area of Concern

High stakes for a globally significant wetland and estuary.

Kevin Harter and Kendra Axness

First paddled and fished by the Ojibwe long before European explorers and French fur traders arrived in the 17th century, the pristine St. Louis River became a vital link connecting the Mississippi River to the west and Great Lakes to the east.

In the decades to follow, dredging to enlarge the natural harbor was conducted and unregulated industries, including timber and iron mining, resulted in the St. Louis River's decline. Its waters became unsuitable for boating, drinking, fishing or swimming. Pellets of a low-grade iron ore called taconite washed onto the shoreline, grain dust blew in the breeze, and oil sheens from refineries and coal gasification plants marred the water's surface.

The St. Louis River is the second largest river flowing into Lake Superior, which is the largest, deepest and cleanest of the Great Lakes. The river runs 179 miles from northeastern Minnesota through the 12,000-acre St. Louis River Estuary to its outlet at the Duluth-Superior harbor.

Where the St. Louis River enters Lake Superior is one of the most biologically rich coastal wetlands and freshwater estuaries in the Great Lakes. It includes shallow backwaters, bays and islands that provide ideal habitat for many resident and migratory bird and wildlife species. It is a unique ecosystem with regional and global significance. It is this significance which makes the stakes for cleanup so high and the opportunities for habitat restoration so exciting.

The Duluth-Superior harbor, which is the largest port on the Great Lakes, be-

came the hub of industrial development for businesses wishing to transport ore, grain, fuel and lumber.

"This was a big, booming industrial area at one time, and we still have industries, and industries are an important part of our economy. But before the Clean Water Act, before the regulations that are in place now, industries just put their waste right into the water," says DNR Northern District Water Leader Nancy Larson.

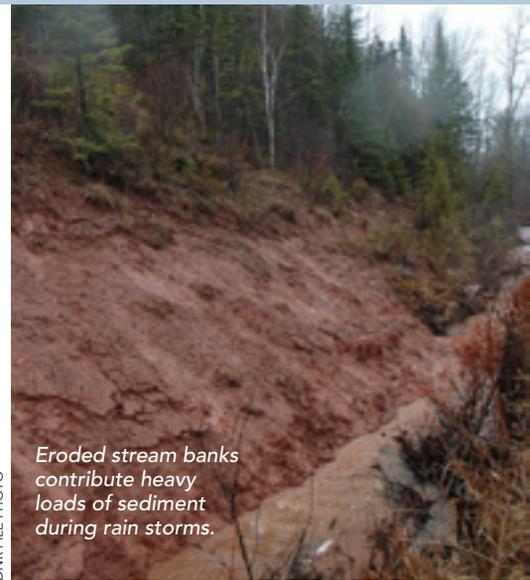
Pollution discharge from industry and consequential river sediment contamination by toxic chemicals resulted in the listing of the St. Louis River as an Area of Concern (AOC). The AOC was also listed due to historic habitat loss from the extensive filling of wetlands and dredging of shallow aquatic habitat. Since 1861, nearly 3,000 acres of wetlands have been filled, and 4,000 acres have been dredged or deepened for navigation.

Today, the St. Louis River AOC — defined as the lower 39 miles of the river, along with the Nemadji River and a portion of Lake Superior — is one of eight remaining AOCs on Lake Superior.

Local communities invest in clean water

One key to restoring the AOC was wastewater treatment. Prior to the 1970s, untreated sewage and industrial waste were significant sources of pollution in the St. Louis River. With the creation in Minnesota of the Western Lake Superior Sanitary District (WLSSD) in 1978 and the establishment of a wastewater treatment

DNR FILE PHOTO



Eroded stream banks contribute heavy loads of sediment during rain storms.

facility in Superior, Wis., water quality conditions improved rapidly. Upgrades to wastewater facilities, pipes and holding tanks have continued in recent years, and water quality has improved as a result. Having stemmed the most significant pollutant flows from so-called "point source" (or end-of-pipe) dischargers, communities turned to cleaning up toxics and restoring habitat.

Collaborative plans chart the course

People living in the areas of northeast Minnesota and northwest Wisconsin have a long history of joint efforts to protect and restore this world-class resource. They worked together to develop a Remedial Action Plan (RAP), published in 1992, that recommended actions within the AOC that would lead to the restoration of beneficial uses. The RAP was updated in 1995 and stated that uses will be restored through programs and measures



Backwaters of the St. Louis River provide an ideal habitat for fish, water birds, amphibians, reptiles and other wildlife.

to control pollution sources, restore habitat and remediate environmental problems.

In 2002, government agencies, stakeholders, and citizens collaborated to produce the St. Louis River Habitat Plan to guide the protection of ecological diversity within the Lower St. Louis River.

Since 2010, Wisconsin and Minnesota have been working together on a strategic action plan to focus remediation and restoration projects on the most important sites. These sites are primarily in the lower river and estuary where the most industrial development occurred; they are also in the watersheds that contribute high sediment loads to the water due to historical logging.

Priorities for delisting the AOC continue to include remediation of contaminated sediments, habitat restoration and reducing sediment loads.

Sturgeon return

Activities that grew out of these initial planning efforts are beginning to pay off. Lake sturgeon were plentiful in the St. Louis River until the early 1900s, when populations declined due to overharvesting, pollution and dam construction. In 1983, the Minnesota and Wisconsin Departments of Natural Resources began stocking sturgeon fry in the river. In 2009, a project to improve habitat conditions for sturgeon spawning was completed. Finally, in 2011 four young sturgeon were collected: the first evidence of sturgeon reproduction in many decades. This is a positive step towards the recovery of this

species in the AOC.

Habitat protection and restoration successes

Habitat protection projects in Wisconsin include the creation of the St. Louis River Streambank Protection Area in 1995 and the purchase of Clough Island in 2010 as a State Conservation Area. A significant milestone in habitat restoration was achieved with Douglas County's Hog Island restoration project from 2009-2012. The Hog Island project was the first remediation to restoration project on the Great Lakes. This type of project combined cleaning up the worst of the pollution (petroleum byproducts called PAHs), and priming the area for habitat improvements by establishing native vegetation.

"Personally, it was very rewarding," says Christine Ostern, Douglas County conservationist, who coordinated the project. "It has not only made a difference for habitat, fish and wildlife, but for people who can again recreate there. It is not only cleaned up and restored, but it is beautiful."

"The goal of the St. Louis River restoration is to create a new legacy that includes a healthy harbor and river for future generations," says Cherie Hagen, DNR's Lake Superior Water Resources Supervisor. •

Kevin Harter is a public affairs manager for the Department of Natural Resources. Kendra Axness is the Policy and Outreach Coordinator for DNR's Office of the Great Lakes.



Great blue heron.



Researchers capture white suckers for tumor and deformity evaluation.

FRANK KOSHERE

WAYNE RUNDELL

LYNELLE HANSON



DNR FILE PHOTO

Local industries assist with the cleanup of legacy pollutants.

Contaminated sediment is safely removed and hauled to special landfills.

BEN UVAAS

Healing the Lower Menominee River

Partners are pitching in.

Kevin Harter and Kendra Axness

Things are looking bright these days for the Lower Menominee River Area of Concern. With several key sediment cleanups underway or completed, a habitat restoration plan in the works, and several habitat restoration projects underway, state resource agencies and the citizens who have contributed local knowledge along the way are seeing the fulfillment of the promise that was made more than 30 years ago. It's been a long road, patiently traveled by those who live near and work on the river.

Early development leads to AOC designation

The Menominee River, the ancestral home of the Menominee tribe, was settled by French Canadian, Swedish, Norwegian and German immigrants. The river and its watershed were ideal for fur trading, commercial fishing, logging, paper-making and shipping industries. As the area developed, the river was polluted by sewage, industrial discharges and chemical runoff in the era before modern environmental regulations prevented the discharge of municipal and industrial waste directly to waterways. Adding to the problems facing the river were over-fishing and dam building.

When the lower six miles of the Menominee River were designated an Area of Concern in 1987, six impairments were identified as applying to the AOC due mainly to contamination of the river bottom by arsenic, coal tar and paint sludge. Known problems with bacterial contamination were beginning to be addressed at the time of AOC designation by the cities of Menominee, Mich., and Marinette, Wis. through programs to separate the storm and sanitary sewers. The natural resources agencies in Michigan and Wisconsin joined forces to address the AOC's remaining problems.

Citizens get involved

One of the requirements for AOCs was to write Remedial Action Plans, or RAPs,

to describe the problems leading to beneficial use impairments and to identify actions for addressing them. Community input was important for writing plans that reflected local stakeholder values, and many citizens generously gave their time in order to participate in meetings to help write the plans.

Steve Zander was hired by Marinette County in the early 1990s to lead RAP implementation, and worked closely with the first Citizens' Advisory Committee to develop the RAP update published in 1996.

"We had a very diverse group of folks at the table, representing different community, business, and environmental interests. I can tell you that the members of the committee didn't always agree, but what they did agree on was that they wanted a cleaner river and healthy economies for Marinette and Menominee," Zander says.

After some early successes — closure of a landfill on the Michigan side and cleanup of the paint sludge offshore from Menominee, Mich. in the 1990s, among others — federal resources for AOCs waned and the members of the Citizens' Advisory Committee stopped meeting. The members went on with their daily lives but always hoped that more work would be done to clean up the river.

States share responsibility

Despite the reduction in federal resources for AOCs during the late 1990s and early 2000s, Wisconsin and Michigan continued to work on the river's rehabilitation. Wisconsin continued discussions with the responsible parties for two significant contaminated sites which contained remnant arsenic and coal tar pollution from early to mid-20th century industrial practices. Wisconsin and Michigan each continued monitoring fish population and health, and looked for opportunities to protect and restore habitat within the AOC.

These agencies had made significant but incremental progress during these years. And then came 2012 — an important year for the AOC. Cleanup of arsenic in the river began, following years of dedicated effort by many to contain or



CHERYL BOUGIE

Restoration of the Menominee River AOC will improve fishing and other recreational opportunities and give a boost to related businesses.

clean up sources of arsenic on land. Later in 2012, coal tar was removed from the river just upstream of the arsenic site. Cleanup at the arsenic site is expected to be completed later this year.

Cleanup for both sites entails dredging the contaminated sediments out of the river and safely disposing of them in properly designed landfills. Additionally, the City of Marinette worked with the Wisconsin Department of Natural Resources to generate engineering and design plans for Menekaunee Harbor, an area that had historically been a commercial fishing center and now has potential to be an important recreational harbor with opportunities for habitat restoration. With these projects in progress, the AOC is well on the way to recovering.

"I think the future of the Menominee River looks bright, thanks to a lot of support from our local, federal, Michigan and Wisconsin partners," says Benjamin Uvaas, DNR's Lower Menominee River Area of Concern Coordinator.

As the cleanup progresses, recreational boating opportunities will increase, and improved navigational depths will help shipping and ship building industries. Habitat for fish — including sturgeon — and wildlife also will be improved, Uvaas says, which will result in a healthier river system benefitting the health and economic wellbeing of the area.

Renewed citizen engagement

With the advent of the Great Lakes Restoration Initiative and the promise of



Area of Concern



North American Hydro, government agencies, and non-profit organizations are working together to create a safe passage for lake sturgeon around the lowest two dams on the river.

cleaner river sediments, Wisconsin and Michigan state agencies have teamed up again with a diverse group of local stakeholders to renew the Citizens' Advisory Committee. Many of the individuals who were there at the beginning came back to work side-by-side with agency staff and new citizen members to develop a plan to preserve and improve habitat in the river. Key pieces of the plan include:

- Providing safe passage around dams for lake sturgeon to increase their population;
- Protecting and improving island and shoreline habitat for water birds like herons; and
- Restoring wetland and aquatic habitat to improve fish spawning success and wildlife populations.

It is estimated that there were once two million adult lake sturgeon in all of Lake Michigan. Over-fishing, pollution and barriers to historic spawning grounds reduced populations to about 3,000.

North American Hydro owns the lowest two Menominee River dams. It is partnering with federal, state and non-profit organizations to create a means for the sturgeon to move around the dams and reach more habitat. The partnership hopes to grow the Lake Michigan sturgeon population to 20,000.

Herons and egrets are large waterbirds that prefer to nest in groups where predators cannot reach them. Islands can be the perfect habitat for them to form nesting colonies. However, nonnative plants like *Phragmites* and buckthorn

Cleanup and spawning habitat restoration is improving lake sturgeon populations.

are invading these islands and out-competing native trees used for nesting. Volunteers are working with the Bureau of Land Management and University of Wisconsin-Marquette to remove nonnative plants and save the colony.

Once contaminated sediments have been removed, environmental agencies and the Citizens' Advisory Committee plan to restore wetland habitat within the AOC. Wetland and quiet backwater areas are important spawning habitat for a number of fish. These areas are especially important for young fish that need to hide from predators and find enough food to grow.

"The Menominee River is an essential part of our lives in this area, yet most people are unaware of its condition," says Dr. Keith West of the University of Wisconsin-Marquette and a CAC member. "Being a part of the Citizens' Advisory Committee for the AOC has been an invaluable education for me. It is our duty as CAC members to get what we have learned out into the community in a way that is accessible and effective."

"We have seen a lot of progress in the last couple years and there will be much more progress in the next couple years," Uvaas says. "We are on schedule for completion of all AOC-related management actions by 2016." With this milestone not too far off on the horizon, AOC partners are energized and excited about meeting these goals and moving beyond.

"Getting the AOC to the point where it



TRYGVE RHUDE



CHAD COOK

Local families participate in a shoreline cleanup day on the Menominee River.



DNR FILE PHOTO

The Menominee River Citizens' Advisory Committee tours a contaminated sediment cleanup site.

is in recovery is something to celebrate," says Uvaas, "but the resource will continue to need care in the future to truly be the best that it can be for the communities."

With so many community members ready to help and care for the river, the future is bright indeed. •

Kevin Harter is a public affairs manager for the Department of Natural Resources. Kendra Axness is the Policy and Outreach Coordinator for DNR's Office of the Great Lakes.



Paper mills discharged PCBs and other pollutants into the Fox River and Lower Green Bay.



Polluted runoff flows into Green Bay from Duck Creek after a heavy rain.

Healing the Lower Green Bay and Fox River Area

A fresh start for the world's largest freshwater estuary.

Kevin Harter

The world's largest freshwater estuary, Green Bay, sustained native cultures for centuries with its abundant fish, waterfowl and wild rice. French explorers, fur traders and many groups of immigrants were also drawn to what is now northeast Wisconsin by its natural resources. Commercial fishing, lumbering, and paper manufacturing industries flourished and led to Green Bay becoming a busy steamship and sailing port.

The region's development, however, left a legacy of toxic chemicals in the river and bay sediments. By 1927, sewage, oil slicks and waste from canning factories and paper mills plagued the river and lower bay. Fish kills became common as paper mill waste depleted oxygen from the water. Health concerns mounted, resulting in one of the earliest beach closings in the country in 1933. Perhaps the most significant toxic chemicals in the river, PCBs, were discharged from paper manufacturers in the mid-1950s through early 1970s.

Over time, agricultural businesses, especially dairying and cheese production, became important to the Fox River Valley economy. Increased farming, along with urbanization, led to greater environmental impacts from soil, nutrients and other pollutants that were carried to the river and streams by rain and snowmelt traveling over land (called "runoff" or "non-point pollution").

Today, the Lower Fox River Basin streams and lower Green Bay suffer from excessive loadings of sediment and nutrients, especially phosphorus. Nutrient inputs to Green Bay, the majority of which are from the Fox River, represent approximately one-third of the total nutrient loading to the Lake Michigan Basin as a whole. The excessive nutrients and sediments in the AOC result in degraded fish and wildlife habitat, an unbalanced

fish community, harmful algal blooms, and poor aesthetics.

The Lower Fox River is considered "impaired" under state and federal water quality regulations. Significant improvements have occurred over the years, but major reductions in nutrients and sediments are still required to achieve a river and bay that are no longer impaired.

With ongoing development and economic growth came the loss of habitat for native fish and wildlife as more people moved to the area, shipping and international commerce expanded, and non-native plants and animals established a foothold. More than 70 percent of Green Bay's wetlands have been lost to dredging, filling and invasive species. Water level changes in Lake Michigan have also reduced habitat; as water levels have decreased in recent years, non-native invasive plants have been able to expand into new wetland areas.

Responding to the challenge

Despite the big and complex problems facing the Green Bay watershed, partners in the area have risen to the challenge and responded patiently, persistently, and strategically. They have focused on projects that bring value back to our largest estuary by helping to achieve goals for cleaning up toxic pollutants, reducing nutrient loads, restoring habitat and improving fish and wildlife populations.

"There was a time it was really bad, but we are making progress, slowly, but surely," says Laurel Last, DNR's Area of Concern Coordinator for the Lower Green Bay and Fox River AOC. "If you talk to folks who have lived here for a long time, they say it is now much better than it used to be."

The Lower Fox River Contaminated Sediment Cleanup project is now in its fifth year of active remediation. This proj-



BROWN COUNTY/US. ACE

Construction of the rock spine structure of the Cat Island Chain restoration project is expected to be complete in fall 2013.



JO TEMTE

Phragmites stands crowd out native species.

ect was designed to reduce risk to human health and the environment due to the presence of PCBs in Fox River sediment. The lower seven miles of the project are in the Lower Green Bay and Fox River AOC. More than 662,000 cubic yards of sediment were dredged from the AOC in 2012. Completion of dredging, capping and sand covering for this project is anticipated in 2017.

Cleanup of PCB-contaminated sediments will address many Beneficial Use Impairments (BUIs), including degradation of benthos, degraded fish and wildlife populations, restrictions on fish and



of Concern

White pelicans are one species that benefits from cleanup and restoration work.

STEVE WAGNER

Green Bay is the world's largest freshwater estuary.

TIM FEATHERS

wildlife consumption, bird or animal deformities or reproductive problems, fish tumors or other deformities, and restrictions on dredging.

To deal with the excessive loadings of sediment and nutrients, U.S. EPA approved a plan that establishes a "pollution budget" for these substances. The plan will drive the implementation of practices to reduce sediment and phosphorus loading to the river and bay. Government agencies, citizens, and non-profit organizations are working together to reduce the levels of these materials entering the river system and bay so the AOC waters can be healthy again.

"We are moving in the right direction. Things are progressing," says Jim Jolly, who has been with the Brown County Land and Water Conservation Department for nearly 30 years and is currently the interim director.

"We are working with agriculture to get phosphorus reductions and, over time, change how agriculture operates," says Jolly, who also coordinated a northern pike habitat restoration project.

Multiple habitat restoration efforts are underway

Reconstruction of the Cat Island Chain, starting with building a 2.5-mile wave barrier along the remnant, began in 2012 after many years of planning by Brown County and the U.S. Army Corps of Engineers. Restoring the islands, along with the quiet water behind them, will lead to recovery of a significant portion of the lower bay habitat and will benefit sport and commercial fisheries, colonial nesting water birds, shorebirds, waterfowl, marsh nesting birds, amphibians, turtles, invertebrates and fur-bearing mammals.

The Duck-Pensaukee Watershed integrated inventory project, led by The Nature Conservancy, includes a wetland assessment and prioritization, fish barrier analysis and prioritization, a northern pike habitat assessment, sediment and nutrient data assessment and wetland restoration. This project will guide the

investment of habitat restoration dollars to the sites that can have the biggest impact within the AOC.

The coastal wetland restoration at the Point au Sable Nature Preserve Project was begun in 2012 to restore approximately 114 acres of coastal wetlands and adjacent uplands at Point au Sable, a prominent peninsula that forms the northeast "corner" of the AOC. This project will restore and improve habitat for numerous fish and wildlife species, including species of conservation concern, and also includes components of aquatic invasive species control (*Phragmites australis*), reduction of phosphorus inputs, and providing technical assistance to private landowners.

Adding to all of these efforts to restore the AOC is a project that asks citizens for their opinions about the appearance of the water and shoreline. The Volunteer Aesthetics Monitoring Program, established in 2011 and expanded in 2012, includes 11 monitoring sites throughout the AOC for which volunteers complete surveys. Information from these surveys will be used to determine the status of this impairment as well as identify problem areas and potential solutions.

"This AOC is complex and challenging, but it's an exciting time to be involved," Last says. "The PCBs are being cleaned up, people are working together to figure out how to meet the sediment and nutrient goals. There are some great restoration projects in progress and being proposed, and there is funding available through the Great Lakes Restoration Initiative. We are making some real progress here." •

Kevin Harter is a public affairs manager for the Department of Natural Resources.

To learn more about habitat restoration for northern pike watch the video at: youtube.com/watch?v=1pTXnL9mmPo

Estuary defined

Green Bay is the largest freshwater estuary in the world. An estuary is a partially enclosed body of water (such as a bay, lagoon, sound or slough) where two different bodies of water meet and mix.

Many estuaries are found where fresh water from a river flows into the salt water of an ocean. A freshwater estuary, on the other hand, can be found where fresh water from a river flows into the chemically distinct fresh water of a large lake (such as one of the Great Lakes). The mixing of water in this transition zone creates unique characteristics. For example, stream water typically has a higher temperature and more suspended solids than Great Lakes water. The mixing of river and lake water in a freshwater estuary can affect water temperature, turbidity, and chemical composition.

Estuaries are unique places that are valuable to the environment and society. Life is dynamic and diverse in estuaries. Some animals and plants specialize in, or adapt to, living in the unique conditions of estuaries. These unique habitats provide a safe haven and protective nursery for small fish, migrating birds and shore animals.

Estuaries act like huge sponges, buffering and protecting upland areas from crashing waves and storms and preventing soil erosion. They soak up excess water from floods and storm surges, and they help filter pollutants and runoff. People enjoy living near estuaries and the surrounding coastline where they can sail, fish, hike and enjoy bird watching. Because of their many benefits, estuaries are often the center of our coastal communities. •

Laurel Last is DNR's Lower Green Bay and Fox River Area of Concern Coordinator.



Healing the Sheboygan River Area of Concern

A community's shared vision leads to a big GLRI boost.

Kevin Harter and Kendra Axness

Sheboygan area partners have been working for more than 30 years to bring the Sheboygan River back to being fishable and swimmable.

Prompted by trapper reports in the early 1980s that mink could not be found when the available habitat indicated that they should be present, DNR scientists sampled sediments in the river and the floodplain. They discovered high levels of PCBs, man-made compounds that were widely used in electrical equipment; they were banned in the United States in 1979 because of environmental concerns. Mink are especially sensitive to these chemicals, with exposure causing their reproductive rates to plummet and local populations to decline or disappear. Like canaries that indicated unsafe air quality in the early days of coal mining, mink indicated the need to improve environmental quality in the Sheboygan River.

While the Department of Natural Resources led efforts to study contaminants and seek funding for sediment cleanup, Sheboygan County led programs to address watershed sources of nutrients, and a local watershed partnership supported agency and community efforts to protect wetlands, educate residents and engage youth. Partners had achieved some success, but still had significant hurdles to overcome. Pollutants remained in the river sediments, limiting opportunities for habitat restoration and navigational dredging. Removing the pollutants would be expensive.

Vic Pappas, DNR's Lake Michigan Field Supervisor, has been around to see things change in the past three decades.



Sheboygan is a popular tourist destination. Cleanup and restoration will enhance our enjoyment of many recreational activities.



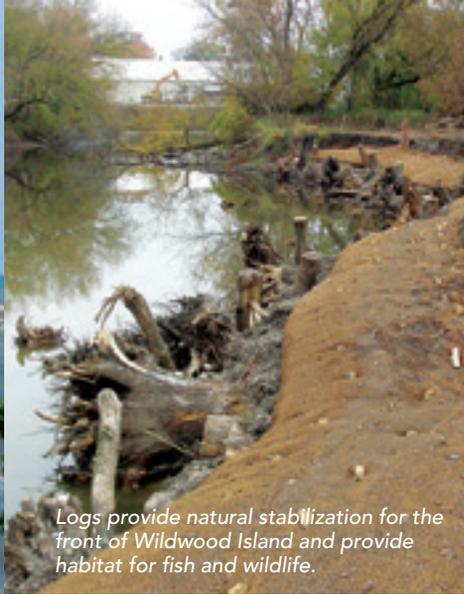
Dredging contaminated sediment from the river continued day and night in 2012.

"After a long time of negotiation, interim steps and study, companies that were responsible for the contamination took care of their responsibilities for sediment cleanup under the Superfund program in recent years," Pappas says. "That really set us on the path to being able to deal with the remaining legacy pollutants and begin restoring habitat."

"Superfund" is shorthand for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, a federal law designed to clean up sites contaminated with hazardous substances.

When the Great Lakes Restoration

Initiative (GLRI) began, Department of Natural Resources and UW-Extension staff convened a technical advisory committee to develop grant proposals that would help guide habitat restoration. Applications submitted early in 2010 were only partially successful. So when EPA approached the group in fall 2010 with a proposal to become a "priority AOC," they jumped at the chance. Priority AOCs receive focused attention and resources to accelerate cleanup and restoration of the river. Sheboygan was one of only four AOCs selected in the United States that year, and the only one in



Logs provide natural stabilization for the front of Wildwood Island and provide habitat for fish and wildlife.

DEBBIE BEYER



CHAD PELUSHEK

STACY HRON

Program Office, Sheboygan County, the City of Sheboygan, UW-Extension, Wisconsin Department of Transportation, Technical Advisory Committee members and many others. An impressive and nearly unprecedented amount of cleanup and restoration was accomplished in under two years:

- More than 400,000 cubic yards of contaminated sediment were removed in approximately 20,000 dump truck loads.
- Five projects were implemented to restore native plants to approximately 34 acres along more than 18,000 feet of shoreline. A sixth project involved in-stream habitat restoration.
- More than 15 projects were carried out to assess fish and wildlife populations, habitat and contaminant levels and impacts.

"We have incredible partnerships, including with the city and county, and everyone is on the same team," says Hron. The goal is to revitalize the Sheboygan River by reducing health threats to people, fish and wildlife; improving fish and wildlife habitat; and increasing recreation and economic opportunities.

In the end, more than \$80 million has been used to address beneficial use impairments in 2011 and 2012.

"We are in the process of healing the river for the fish, wildlife and the community," says Hron. "People had waited for quite some time and they are very excited to see this happening."

From Area of Concern to area in recovery

Sheboygan was once a primary port for ships carrying European immigrants who settled the area. The strong German influence led to the establishment of beer and cheese factories. Fur trading, sawmills, tanneries, ship building, shipping, manufacturing of shipping barrels, and commercial fishing also prospered. With abundant water and an ample immigrant workforce, Sheboygan developed a vibrant manufacturing industry.

Over time, industrial, urban and agricultural pollution contributed to the river's degradation. Pollution from many years of heavy manufacturing led to the Sheboygan River and harbor's designation as a federal "Superfund" site in 1986.

In 1987, the lower 14 miles of the Sheboygan River and the harbor were designated as one of 43 Great Lakes Areas of Concern, primarily due to contamination from PCBs and another industrial waste that persists in the environment — polynuclear aromatic hydrocarbons (PAHs). These compounds are found in oily wastes that were discharged from an early 20th century coal gasification plant. The designation was also due to the decline of fish and wildlife populations and habitat loss.

Nine impairments were identified in the river. Contaminated sediments resulted in fish and waterfowl that are not safe to eat and impaired use of harbor areas due to dredging restrictions. Pollution is also suspected of contributing to the degradation of wildlife, fish, benthos (bottom-dwelling critters) and plankton populations. High levels of nutrients have caused nuisance algal blooms in the past. Sedimentation and habitat loss were also issues in the AOC.

Now that all necessary AOC-related actions have been taken to address the impairments, the Department of Natural Resources and its partners will continue to monitor the river for recovery while attending to some remaining details of the sediment cleanup and habitat restoration projects. When verification and monitoring data show that AOC goals have been met, the AOC will be formally delisted.

In the meantime, AOC partners will begin to dream bigger — even with as much as was accomplished with AOC projects, more can be done.

"There are a lot of people keeping the ball rolling," Hron says.

"After many years of on-again-off again work, the AOC really was a needed project," says Jon Gumtow, a citizen who has been involved in the AOC and is secretary of the local watershed group.

"We were really engaged in the process of cleaning up the river, but we couldn't do much without funding," says Gumtow, who has been involved in the river cleanup for more than 30 years. "Now that the river is getting cleaned up, for me, the most exciting thing is the people who are again enjoying it."

The area that was once mink-free is becoming mink friendly once again. •

Kevin Harter is a public affairs manager for the Department of Natural Resources. Kendra Axness is Policy and Outreach Coordinator for DNR's Office of the Great Lakes.

Wisconsin.

"We felt like we were being offered this great opportunity," says Debbie Beyer, UW-Extension Natural Resources Educator who helped facilitate the meetings and conduct outreach.

Stacy Hron, the DNR's Sheboygan River Area of Concern Coordinator, adds, "We knew we were taking on a lot, but we also knew that we had a shared vision for the river and partners who were willing to go the extra mile to make it work."

Work it did, with close partnerships between the Department of Natural Resources, U.S. EPA's Great Lakes National



WISCONSIN HISTORICAL SOCIETY

Historically, Milwaukee's rivers and lakefront were a recreational treasure.

Healing the Milwaukee Estuary Area of Concern

An urban center gets a second chance.

Kevin Harter and Megan O'Shea

Milwaukee, a major Great Lakes port since 1835 and Wisconsin's largest city, is at the heart of the Milwaukee Estuary. It is where the three rivers of the estuary — the Milwaukee, Menomonee and Kinnickinnic — converge. It is the home of thousands of urban residents who are looking for places close to home to escape the bustle of the city. With many area partners working to bring nature back to the city, these urban residents are finding more opportunities to fish, swim, and enjoy green spaces right in their neighborhoods.

In the early years of Milwaukee's history, before pollution took its toll, local residents and visitors used these rivers for many types of recreation — swimming, fishing, boating and ice skating. As the area grew into a center for shipping, commerce and industry, the balance between nature and the human-built environment was lost. The rivers were dammed, dredged, straightened, widened and often lined with concrete. More than a century of agricultural, industrial and residential development led to pollution of these waterways. In 1951, an oil spill caused a Milwaukee River tributary to catch fire, a symptom of an ailing waterbody that could no longer be used for fishing and swimming and indeed posed a safety hazard to the community.

Because of the severe pollution that had degraded the waterways, the estuary was designated as an Area of Concern in 1987.

"Historically, issues were a lot different than what we know today, and in some cases people didn't know, or consider the consequences of what they were doing," says Megan O'Shea, DNR's Milwaukee Estuary Area of Concern Coordi-



TOM SEAR

Top: In 2010, the Milwaukee Metropolitan Sewerage District removed a section of concrete lining on Underwood Creek in Wauwatosa.



MEGAN O'SHEA

Bottom: The same location today after the Sewerage District removed the concrete and naturalized the channel. Projects like this help enhance habitat and aesthetic appeal.

nator. "There was pollution from a variety of sources, ranging from agricultural runoff and industrial dumping, to driveway oil and yard chemical runoff."

Rejuvenating the rivers

Working closely with a variety of partners, the Department of Natural Resources is helping to coordinate the cleanup of pollution in the rivers and near-shore waters of Lake Michigan with the goal of restoring the rivers' place in the community as urban natural treasures. Removing polluted sediments from the rivers and adjacent lands is an important first step.

In 2009, a public and private partnership paved the way for the revitalization of the Kinnickinnic River by cleaning up toxic contamination in a section of

the river. Public and private investments also made cleanup projects on the Little Menomonee River and portions of the Milwaukee River possible.

These projects are complex and many partners are needed to successfully carry them out. The Department of Natural Resources, Milwaukee County and U.S. EPA's Great Lakes National Program Office Legacy Act Program have each made important contributions to the cleanups. To date, approximately 300,000 cubic yards of sediments, many contaminated with toxic chemicals, have been removed, improving conditions in the water and in the local communities.

In addition to cleaning up toxic contamination, minimizing the amount of runoff and keeping it clean is another key

Enjoying an improved
Bradford Beach.



MEGAN O'SHEA

What looks like wilderness
on the Milwaukee River
is just a few miles from
downtown.



GAIL EPPING-OVERHOIT

Cleanup and restoration increases
recreational opportunities on
Milwaukee's rivers.



KAE DONLEVY

to balancing the human-built and natural environments.

As rain or snowmelt passes over developed land, it picks up pollutants and transports them to the nearest storm drain and eventually into local water ways. This runoff is often also laden with trash, bacteria and nutrients like phosphorus and nitrogen. Consequently, this type of pollution closes local beaches and can harm or kill fish and other wildlife. Runoff pollution plays a role in beach closings, which periodically occur in many of Milwaukee's lakefront beaches.

The University of Wisconsin-Milwaukee is using innovative bacteria source identification methods, which will help ensure that safe conditions exist for

water-based recreation in Milwaukee. Local partners are also working hard to control runoff pollution, with progress that can be seen and enjoyed. Bradford Beach on the East Side of Milwaukee is one example. The beach was once underused and littered with trash. It is now one of Milwaukee's most popular lakefront destinations and even earned Blue Wave certification, the first national environmental certification for beaches.

Creating a healthier place for all

Along with cleaning up sediments and reducing runoff pollution, habitat work is important for restoring the waterways. Improving fish passage by removing structures like dams and blocked culverts opens up miles of streams to fish that weren't accessible to them before. This helps ensure that fish have a diverse array of habitats to help meet their critical life cycle needs as they migrate between Lake Michigan and its tributaries. Such habitat restoration has occurred in portions of the Milwaukee River, Menomonee River and Underwood Creek. Citizens are playing an important role in improving fish passage by assessing fish passage impediments in AOC tributaries.

Removing concrete lining from river channels and restoring streams to more natural conditions is another way to improve habitat in cities like Milwaukee. Such habitat restoration has occurred in portions of the Kinnickinnic River on Milwaukee's south side, the Menomonee River in the Miller Valley and Underwood Creek in the City of Wauwatosa. Restoring stream conditions not only helps fish, but also improves conditions for the aquatic invertebrates (see p. 5, "What Lives in the Mud") on which the fish feed.

Besides helping fish and other aquatic life, restoring more natural stream conditions makes the stream more attractive. Aesthetic problems can keep people from fully enjoying the water. In order to assess the aesthetic conditions in the AOC that might interfere with enjoyment of the area's waters, the Department of Natural Resources has developed a collaborative citizens' monitoring program. With help from citizen volunteers, the Department of Natural Resources will be able to identify the sources of aesthetic problems and implement strategies to address them.

Where the built environment cannot be altered, there may be other ways to improve habitat. Riverbanks along the Milwaukee Estuary shipping channel have been widened, dredged and hardened to provide structural stability and eliminate erosion from passing barges. These structures are necessary to protect the streambank, but they make it difficult for young fish to survive their

trip to the lake from upstream spawning beds.

A local nonprofit group is working with a team of regional experts to install innovative rubber containers that are attached within the corrugations of steel bulkheads. They contain a variety of wetland plants that young fish use as food and shelter to rest as they migrate back to Lake Michigan. The design included considerations for wall conditions, water quality, freeze/thaw patterns, ice and wave action, tolerant vegetation and fish species' needs.

Through their hard work and dedication, partners are making great strides in the Milwaukee Estuary, ensuring its ability to thrive in both the built and natural environments and providing a healthy place for people and wildlife.

"After hundreds of years of development, we will never get back to pre-settlement conditions, but we are seeing progress," says Ann Brummitt of the Milwaukee River Greenway Coalition. "Overall, people feel pretty hopeful. We are improving habitat, [biological] diversity and fish populations." •

Kevin Harter is a public affairs manager for the Department of Natural Resources. Megan O'Shea is DNR's Milwaukee Estuary Area of Concern Coordinator.



DAVE TURCIANO

Dam removal and habitat restoration are bringing lake sturgeon back to Milwaukee's waters.

To learn more about the Milwaukee Estuary Area of Concern and partner efforts watch the following videos:

(A Community Returns to Its Rivers)
youtube.com/watch?v=gpLJ0f3J3P0

(Connecting Milwaukee's Youth)
youtube.com/watch?v=V0YamFLhzB4

HEALING OUR RIVERS & HARBORS

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