

Department of
Environmental
Conservation

ROCHESTER EMBAYMENT AREA OF CONCERN

Eutrophication or Undesirable Algae
Beneficial Use Impairment Removal Report

APRIL, 2018 **(DRAFT)**



Rochester Embayment Area of Concern
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Beneficial Use Impairment (BUI) Removal Report

April, 2018

Prepared by:

New York State Department of Environmental Conservation

And

Monroe County Department of Public Health

This Beneficial Use Impairment (BUI) Removal Report was prepared by the New York State Department of Environmental Conservation (NYSDEC) and the Monroe County Department of Public Health (MCDPH) and was substantially funded by the United States Environmental Protection Agency (USEPA) through the Great Lakes Restoration Initiative (GLRI). The NYSDEC and MCDPH have engaged stakeholders and the public, including the Remedial Advisory Committee, through the BUI removal process. For more information please contact the Remedial Action Plan Coordinator at MCDPH or the AOC Coordinator at NYSDEC Division of Water.

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1. Introduction and Report Purpose

The International Joint Commission (IJC) has identified 43 Areas of Concern (AOC) in the Great Lakes Basin where pollution from past industrial production and waste disposal practices has created hazardous waste sites and contaminated sediments. Up to fourteen beneficial uses impairments (BUIs), or indicators of poor water quality, are used to evaluate the condition of an AOC.

The Rochester Embayment AOC encompasses the lower portion of the Genesee River from the mouth up to the Lower Falls in Rochester, NY and the portion of Lake Ontario within a straight line drawn from Bogus Point to Nine Mile Point (Figure 1). This was originally listed as an AOC due to the known or suspected presence of multiple BUIs, including “Eutrophication or Undesirable Algae,” which is generally considered impaired when waters used for body contact recreation exceed standards, objectives, or guidelines for such use.

Following an evaluation of the data and evidence gathered to address this impairment, the New York State Department of Environmental Conservation (NYSDEC) has determined that the specific criteria needed to remove (or re-designate from ‘Impaired’ to ‘Not Impaired’) the Eutrophication or Undesirable Algae BUI is met. The local community advisory group, called the Remedial Action Committee (RAC), fully supports the removal of this BUI. Accordingly, the purpose of this BUI removal report is to present the rationale and supporting data to remove the Eutrophication or Undesirable Algae BUI from the Rochester Embayment AOC.

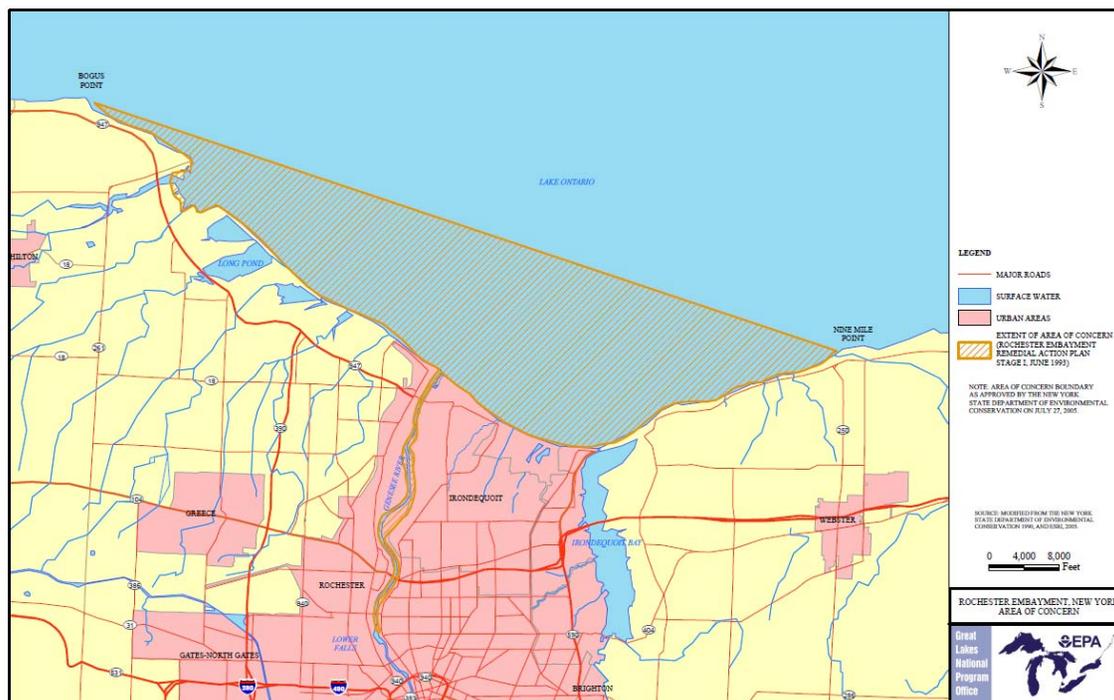


Figure 1. Map of the Rochester Embayment AOC.

2. Background & BUI Removal

All AOCs develop a Remedial Action Plan (RAP) in three stages, which collectively identifies specific BUIs and their causes (Stage I), outlines the restoration work needed (Stage II), and documents completion of these restoration activities and the delisting of the AOC (Stage III). Currently, the Rochester Embayment RAP consists of the Stage I and Stage II RAP.

The Eutrophication and Undesirable Algae BUI is listed as impaired in the Stage I and Stage II RAPs due to:

- The introduction of contaminated water from Genesee river tributaries containing fertilizers or phosphate detergents. (agriculture, sewage, ect.)
- The reintroduction of phosphorus sediments exposed by benthic sediment disturbance (dredging)
- An invasive mussel species introduction resulting in an increase in suitable algae habitat and greater access to sunlight and nutrients.

2.1. BUI Removal Criteria

The removal criteria and monitoring methods for the Eutrophication or Undesirable Algae BUI were first reported in the 2002 Addendum to the Stage II RAP developed by the RAP Oversight Committee in conjunction with the Water Quality Management Advisory Committee. This removal criteria was reevaluated in 2008 by the RAP Coordinator as well as the RAP Oversight Committee. The RAP Oversight Committee determined that the use of these criteria should continue due to their continued relevance to the local conditions at Rochester Embayment and the IJC Delisting Guideline for this BUI.

As stated in the Rochester Embayment Area of Concern Beneficial Use Impairment Delisting Criteria Report (E&E 2009), the Eutrophication or Undesirable Algae BUI can be removed when:

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

This can be demonstrated by meeting the BUI removal criteria (MCDPH, 2002):

- **Total phosphorus concentrations for near (11 to 12 meters) and near- nearshore (1 meter) are less than or equal to 15 ppb and 20 ppb, respectively; and**
- **Chlorophyll a concentrations for the near (11 to 12 meters) and the near- nearshore (1 meter) are less than or equal to 3.8 ppb and 5 ppb, respectively; and**
- **Secchi disk measurements in the nearshore (12 meters) are greater than or equal to 4 meters.**

The above BUI removal criteria is consistent with United States Environmental Protection Agency (USEPA) Delisting Guidance document (USPC 2001) and the International Joint Commission (IJC) delisting guidelines (IJC 1991).

2.2. BUI Removal Comments and Report Preparation

The following questions were asked when evaluating whether to proceed with the change in eutrophication or undesirable algae status:

1. Are the methods and results cited in the report or presentation materials technically and scientifically sound?
2. Does the information cited in the report regarding restoration of the impaired beneficial use support the delisting criteria?
3. Does the RAC and general public concur that the delisting criteria have been met?

The evaluation included conducting a thorough review of technical reports and supporting documents.

2.3. BUI Indicator Status Resolution

In addition to successfully achieving the criteria as stated above, an alternate form of BUI removal includes supplying evidence that demonstrates the impairment is not localized to the area of concern, Rochester Embayment, but rather is a regional concern. This exception is in place such that in cases where local actions would result in minimal remedial impact in regards to lake wide impairment, resources can be used more productively.

2.3.1. Strategy and Rationale:

The United States Environmental Protection Agency (USEPA) Delisting Guidance document, Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines, accepted by the United States Policy Committee (USPC 2001) states the following:

“Re-designation of a BUI from impaired to unimpaired can occur if it can be demonstrated that:

- Approved delisting criteria for that BUI have been met;
- The impairment is not solely of local geographic extent, but is typical of upstream conditions OR conditions outside of the AOC boundaries on a regional scale. Such re-designation would be contingent upon evidence that sources within the AOC are controlled;
- The impairment is due to natural rather than human causes.”

The IJC delisting guidelines (IJC, 1991) state that the “Eutrophication or Undesirable Algae” beneficial use may be deemed Not Impaired “When there are no persistent water quality problems (e.g., dissolved oxygen depletion of bottom waters, nuisance algal blooms, or accumulation decreased water quality) attributed to cultural eutrophication” (IJC, 1991).

3. Addressing BUI Removal Criteria

A compilation of data collected on the conditions of Lake Ontario including areas internal and external to the Rochester Embayment AOC were compared resulting in the measurements supporting the removal of the Eutrophication or Undesirable Algae BUI described below:

3.1. Criterion 1: Total Phosphorus Concentrations

Bi-national involvement has led to a lake wide total phosphorus concentration decline from 25 ppb in 1971, to 10 ppb in the mid-1980s, and most recently 5 ppb to 7 ppb in the mid-2000s. In 2007 Holeck et al. performed a study on 38 offshore, 5 nearshore, and 3 embayment sites in Lake Ontario within the southern and eastern shores. Nearshore data was collected at depths of 10 meters (comparable to the delisting criteria of 11 to 12 meters) and off shore samples were collected at 8 and 40 meter depths. Average total phosphorus levels for both nearshore and offshore areas were 7.9 ppb and 7.2 ppb, respectively, which are well below the 15 ppb set delisting criteria. For the areas of embayment average total phosphorus levels were determined to be 15.1 ppb, just above the criteria for delisting but a significant improvement in comparison to the 1970 levels. The 3 embayment areas referenced may not be comparable to the Rochester Embayment due to differences in physical structure in regards to seclusion from lake cycling. These 3 areas are more secluded than the Rochester Embayment AOC resulting in predicted higher total phosphorus concentrations due to accumulation and lesser flow between bay and lake. This study supports that total phosphorus concentrations are improving and embayment areas are more susceptible to higher phosphorus levels overall.

3.2. Criterion 2: Chlorophyll a Concentrations

The established delisting criteria for chlorophyll a is concentration for nearshore (11 to 12 meters) and near-nearshore (1 meter) are less than or equal to 3.8 ppb and 5 ppb, respectively. Though the amount of chlorophyll a studies within the Rochester Embayment AOC are limited, a study presented by Makarewicz and Howell in 2008 reported between 2003 and 2005 chlorophyll a concentrations of 3.1 ppb in the Genesee River/Embayment area. In addition to those results, concentrations of greater than 14 ppb occurred in three locations outside of the AOC as well as two locations within the AOC. This data supports that the lake wide concern for high chlorophyll a concentrations due to excessive *Cladophora* growth are not limited to the Rochester Embayment AOC but occurs external to the area as well.

3.3. Criterion 3: Secchi Disk Measurements

The approved delisting criteria for Secchi disk depth is measurements in the nearshore (12 meters) are greater than or equal to 4 meters. In 2003 Mills et al. reported an average Secchi disk depth for nearshore and offshore areas of Lake Ontario for the spring, summer, and fall as 10.3, 7.8, and 6.7 meters, respectively. All of which are greater than required by the delisting criteria. Additionally, a more recent study performed in 2007 by Holeck concluded Secchi disk depths of nearshore sites as 6.9 meters compared to readings of 3.4 meters at embayment locations of Sodus, Sandy Pond, and Chaumont. This data supports the argument that embayment areas lake wide are not in condition to reach Secchi disk depths required by the delisting criteria for the Rochester Embayment AOC and therefore supports eutrophication and undesirable algae as a lake wide issue.

3.4. Criteria Conclusions

Through interpretation of the data addressed above, it can be determined that the conditions of the Rochester Embayment AOC are not limited to the local area but are comparable to many embayment areas surrounding Lake Ontario. Therefore, it is recommended that additional actions and programs be implemented in areas outside of the AOC including other tributaries to Lake Ontario as well as the upstream watershed of the Genesee River. By implementing nutrient management actions both internal and external to the AOC the greatest result on limiting the conditions seen in the Rochester Embayment AOC that are consistent with the Eutrophication or Undesirable Algae BUI can be achieved.

4. Local Activities Supporting BUI Removal

Several projects have been implemented in order to support the continued management of eutrophication or undesirable algae in the Rochester Embayment AOC in regards to the main factors that contribute to the prolific growth of *Cladophora*. The following projects and programs support or contribute to the BUI removal, as summarized below.

4.1. Combined Sewer Overflow Abatement Program (CSOAP)

Historical water quality problems associated with effluent discharges in and around Ontario Beach resulted in the development of a comprehensive sewerage system for the City of Rochester in the early 1900's. Still, by the 1960's, most of the County's water resources were affected by pollution. This led to the creation of the Monroe County Pure Waters Agency in 1967. Through this agency, a comprehensive plan was developed and released to address the county's sewerage needs through the year 2020. The plan recommended the construction of a regional sewerage conveyance and treatment system to aid in the handling of effluent entering creeks and streams in Monroe County. In addition to developing a master plan for the Rochester sewage system, in 1972 the extended staff of Pure Waters accepted responsibility for the care and maintenance of these systems. In conjunction with the Pure Waters plan, the development of the Combined Sewer Overflow Abatement Program (CSOAP) was created and began operation in 1993. Through a series of tunnels and holding basins, over 99% of the total volume of CSO's is captured and properly treated at the Frank E. VanLare Wastewater Treatment Facility. This program saves an average of 3.75 billion gallons per year of untreated overflow from entering local waterways. This update allows for a significant decrease in nutrient loading into the Rochester Embayment AOC resulting in a better condition for the management of algal growth and eutrophication effects with in the local area.

4.2. Comprehensive Nutrient Management Plan (CNMP)

The Genesee River encompasses a watershed of 2,373 square miles in New York including 8 counties outside of Monroe before reaching the Rochester Embayment and flowing into Lake Ontario. This large area linked through one watershed allows for the accumulation of pollutants and nutrients to occur as more tributaries connect to the Genesee River as it flows towards Lake Ontario. As stated in the USGS LONNS 2013, approximately 42% of total phosphorous deposited by the Genesee River into the Rochester Embayment is due to non-point source farming practices. To address the non-point agricultural sources the United States Department of Agriculture (USDA) and the EPA developed the Unified National Strategy for Animal Feeding Operations in 1999 which implemented the voluntary and regulatory expectations for animal feeding operations including the construction of Comprehensive Nutrient Management Plans (CNMP). The practices included in CNMPs encourage environmentally conscious farming methods that help to limit animal waste runoff and other sources of nutrient loading upstream in

the Genesee River. These practices included constructing manure storage facilities, concrete protection in high use areas to inhibit erosion, and planting cover crops to create a riparian zone buffer. Through Natural Resource Conservation Services, financial aid may be provided through the Environmental Quality Incentives Program (EQIP) to assist in the development and continuation of a CNMP for each project. By implementing CNMP practices a greater amount of water high in nutrient load may be purified naturally before adding to the Genesee watershed thus limiting the nutrient load contamination of the Rochester Embayment AOC.

4.3. Algae Control System

Excessive masses of stagnant algae, especially *Cladophora*, have traditionally accumulated in the nearshore area adjacent to the West Pier at Ontario Beach, and have been responsible for decreased water quality and the expression of eutrophic conditions. In years past, the control of algal mats has required both manual and mechanical collection systems, which resulted in inefficient removal. To address this problem, an algae control system was developed, and tested in a demonstration project in 2011. The system consists of a combination of a portable pump, intake, piping and hoses, which collect the algae from the West side of the pier and redistribute to the East side of the pier (Genesee River). The algae are eventually carried out to the deeper lake waters via river flow where conditions are less optimal resulting in algal and bacterial death. The 2011 demonstration project was conducted by the United States Army Corps of Engineers (USACE) with their contractor, URS. The operation of the system during the demonstration project was made possible by the joint efforts of the Monroe County Departments of Public Health, Environmental Services, and Parks. Upon completion of the successful demonstration project, recommendations were made to implement the system as a permanent operation. Funding was provided from the USEPA Great Lakes National Program Office (GLNPO) to the New York State Department of Environmental Conservation (NYSDEC). Monroe County contracted with NYSDEC to acquire the funds to purchase the equipment and complete the work needed to cut the pier, install the piping, and related activities to get the system up and running. Monroe County also matched funding by agreeing to future operation and maintenance of the system. Ownership and maintenance of this system is the responsibility of the Monroe County Department of Environmental Services while operation of the algae pump is overseen by the Department of Parks. After being operational for the full 2015, 2016, and 2017 beach seasons, the system has proved to be effective in the elimination of algal mats previously known to accumulate in this area.

4.4. Water Education Collaborative (WEC)

One of the greatest sources of nutrient loading and contamination in the Rochester Embayment AOC and other local waterways is stormwater runoff carrying pollution from roadways, parking lots, and other impervious surfaces, as well as from lawn care, and other homeowner activities. To help mitigate this problem, the Water Education Collaborative (WEC) was established in 2001 in response to a recommendation in the Rochester Embayment Remedial Action Plan Stage 1. The mission of the WEC is to create a partnership between environmental and community organizations in order to encourage education of the public through programming consistent with the Rochester Embayment Remedial Action Plan (RAP) and other water resources within the community. Through this platform the WEC, with the support of Causewave Community Partners (formerly the Advertising Council of Rochester) and the Stormwater Coalition of Monroe County, launched the H2O Hero campaign in 2007 with the vision that individuals can have a positive impact on local water conditions through awareness and modest changes in certain everyday activities. Through this campaign the WEC offers interactive educational resources on the main sources of residential pollution, and shows residents how they can reduce their pollution contribution and exhibit more environmentally responsible

behavior through the proper use and storage of household and yard care products. By implementing the WEC and the H2O Hero campaign, the population within the regional watershed of Lake Ontario can better understand how they impact local water quality as well as how they can actively participate in the efforts to improve and protect these water resources through the reduction of nutrient and pollutant loading in the Rochester Embayment AOC.

5. Evidence Supporting Lake-Wide Issue

Thorough analysis of research was completed resulting in the supporting evidence for the removal of the Eutrophication or Undesirable Algae BUI as follows:

5.1. Invasive Mussel Species

Though the algal genus *Cladophora* is native to the Great Lakes ecosystem, anthropogenic causes, such as excessive nutrient deposition, have allowed for this genus to flourish to the point of system impairment. Policies have been set to reduce these deposits but the use of these nutrients is amplified in the ecosystem due to invasive mussel species including zebra and quagga mussels. These mussels act to transfer nutrients suspended in the water into the benthic sediments allowing for the algae to access these nutrients and grow excessively. In addition to nutrient transfer, the invasive mussels consume phytoplankton resulting in a decrease in phytoplankton population and an increase in water clarity. This increase in clarity allows for sunlight to penetrate farther in water thus increasing the littoral zone or area suitable for *Cladophora* growth and further increases the abundance of undesirable algae. Examples of these mussel invasions and environmental impacts can be seen in the Rochester area but are present lake wide and are of environmental concern for a majority of the Great Lakes.

5.2. Increased Surface Water Temperature

Lake Ontario has experienced a gradual increase in surface water temperatures over the past few decades resulting in adverse effects in algae growth. Since 1980 the surface water temperatures for Lake Ontario have risen approximately 0.96°C per decade allowing for environmental changes to occur including spikes in *Cladophora* algal growth (Malkin, 2008). Increases in water temperatures can lead to a decrease in annual ice coverage and in turn an increase in the growing seasons for algae. In addition to lengthening growth periods, rising water temperatures are expected to expand the suitable ranges for invasive species such as zebra and quagga muscles. By increasing their suitable habitat these species can better facilitate a nutrient rich environment for *Cladophora* to grow at nuisance levels. This change in water temperature can be seen locally in the Rochester Embayment AOC but is also consistent throughout Lake Ontario as a whole and therefore cannot be addressed as a localized impairment of the Rochester Embayment AOC.

5.3. Lake Wide Nutrient Deposition

Due to the natural flow of the Great Lakes, with Lake Ontario farthest downstream, nutrient loading at all of the Great Lakes adds to the impacts of eutrophication seen in Lake Ontario and the Rochester Embayment AOC. With approximately 83% of all surface water in Lake Ontario deriving from Lake Erie via the Niagara River the transfer of soluble nutrients and pollutants can occur from lake to lake (EPA, 2001). With this large of a water contribution the Niagara River is responsible for the greatest amount of nutrient deposition of all major sources into Lake Ontario. In addition to the interconnectedness of the Great Lakes, Lake Ontario is also strongly influenced by nutrient sources contained within the lake's watershed. Through the comparison of the area of lake watershed to lake surface area, Lake Ontario has the highest ratio and

therefore results in higher sensitivity to terrestrial non-point sources of nutrients and pollutants as compared to the other Great Lakes. This factor results in the increased difficulty of the localization of sources upstream of major river systems flowing into Lake Ontario including the Genesee River. Water is constantly cycled between the Great Lakes and within the Lake Ontario watershed. The interconnected quality of the lake system makes nutrient deposition difficult to localize and confine to one area. With the amount of water passing through the Rochester Embayment via external sources, whether inter lake or upstream, nutrient load dependent eutrophication is amplified due to sources outside of the AOC thus creating a lake wide issue.

5.4. Lake Wide *Cladophora* Shoreline Occurrence

Due to a variety of factors, as referenced above, *Cladophora* has developed excessively across a majority of Lake Ontario's shoreline thus resulting in the lake wide impairment of undesirable algae and eutrophication. This impairment can also be exemplified at the international level through the documentation and conducted research on the Canadian coast of Lake Ontario. A study performed by Makarewicz and Howell indicated widespread nuisance levels of algae growth along the northern coast of Lake Ontario with the highest algae biomass occurring on the western shore including the Toronto and Halton area. This information on the occurrence of algae in Halton was also recorded in the Lake Ontario Shoreline Algae Action Advisement Committee (LOSAAAC) report developed specifically to address *Cladophora* excessive growth in this area. Reviewing the reported cases of *Cladophora* caused impairments along the Lake Ontario coast including areas external to the AOC allows for the representation that excessive growth of *Cladophora* is an impairment beyond the Rochester Embayment AOC and therefore should be addressed as a lake wide issue rather than a local impairment.

6. Public Outreach

Rochester Embayment Public Meeting, March 15th, 2018 – Eutrophication and Undesirable Algae, Beach Closing, and Restrictions on Dredging Activities.

The New York State Department of Environmental Conservation and the Monroe County Department of Public Health hosted a public meeting on the status of Rochester Embayment Beneficial Use Impairments at 5:30 p.m. on March 15, 2018 at the Roger Robach Community Center, 180 Beach Avenue. Notification of this meeting was distributed to local government officials, local media, and local environmental advocacy groups. Postcards were mailed to 600+ local resident addresses. Approximately 40 people attended. Pamphlets about the Area of Concern and its Beneficial Use Impairments were distributed and posters on each Beneficial Use Impairment were displayed and staffed by State and County experts. Comments were overall positive and the few questions formally posed were answered.

Commenter 1 –
Response –

7. Summary and Conclusion

The Eutrophication or Undesirable Algae BUI was originally listed as impaired due to increased phosphorus concentrations due to the introduction of contaminated water from Genesee river tributaries containing fertilizers or phosphate detergents (agriculture, sewage, etc.), an increase in phosphorus concentrations due to the reintroduction of phosphorus sediments exposed by benthic sediment disturbance (dredging), and an invasive mussel species introduction resulting in an increase in suitable algae habitat and greater access to sunlight and nutrients. Through the RAP process, several measures were taken to improve water quality and reduce the occurrence of eutrophication or undesirable algal blooms. The NYSDEC has determined that the data presented herein illustrates that the water quality in the Rochester Embayment AOC is representative of a lake wide issue and therefore the Eutrophication or Undesirable Algae BUI should be removed (The impairment is not solely of local geographic extent). In addition, the RAC fully supports the removal of this BUI.

Appendices

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