# Delisting Criteria Discussion for the *Degradation of Benthos* Beneficial Use Impairment (BUI) in the St. Marys River Area of Concern (AOC)

# **1.0 Objective:**

To propose updated delisting criteria for the *Degradation of Benthos* BUI for the Canadian side of the St. Marys River AOC that reflects current science, local environmental initiatives, and creates parallels to the *Canada-Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment*. Delisting criteria are measurable targets for restoring beneficial uses and establish a benchmark for when a beneficial use can be deemed no longer impaired under the Remedial Action Plan (RAP).

# 2.0 Reasons Originally Identified for BUI Impairment:

In the Stage 1 RAP report (1992), the *Degradation of Benthos* BUI was divided into two parts: (a) dynamics of benthic populations and (b) body burdens of benthic organisms. The following explains the reasons for impairment <u>at that time, and are not a statement on current conditions within the AOC</u>:

- a) Dynamics of benthic populations
  - Benthic macroinvertebrate communities were impaired along the Ontario shore downstream of the Algoma Steel, St. Marys Paper and East End Waste Water Treatment Plant as evidenced by the presence of pollution tolerant species and low diversity. Complete recovery of the benthic communities occurs in the lower section of Lake George, 24km downstream of the industrial discharges. Sediments within the Algoma Steel boat slip were acutely lethal to the larvae of the burrowing mayfly (*Hexagenia limbata*).
- b) Body burdens of benthic organisms
  - There was exceedance of the Severe Effect Level for polycyclic aromatic hydrocarbons (PAHs) in several locations in the river; for iron at several sites; and for arsenic, nickel and manganese at the Algoma Steel slag yard.

### 3.0 Original BUI Delisting Criteria:

The original delisting criteria in the Stage 2 RAP [2002] report stated the BUI would be considered "Not Impaired" when the following conditions were met:

- Due to frequent disruption of benthic communities within navigational channels, as a consequence of ship traffic and navigational dredging, emphasis is placed on demonstrating the absence of acute and chronic effects of sediment-associated contaminants and on demonstrating bioassay end points comparable to controls.
- Benthic community structure outside the shipping channel is not significantly different from control sites of comparable physical and chemical characteristics.

When benthic macroinvertebrate community structure does not significantly diverge from un-impacted sites of comparable physical and chemical characteristics. Populations of mesotrophic species such as mayfly (*Hexagenia*), fingernail clam (*Pisidium*), and oligochaetes (*Ilyodrilus templetoni* and *Spirosperma ferox*) are present where suitable substrates are located, and historical data indicates that these organisms are native to the area.

— In the absence of community structure data, this use may be considered restored when toxicity of sediment associated contaminants is not significantly higher than controls. Resident fauna does not have elevated contaminant levels relative to unimpacted areas.

The initial Stage 2 RAP delisting criteria were developed for the AOC in 2002, and were all updated in 2015 – with participation and support of the Binational Public Advisory Council (BPAC) – with the exception of the *Degradation of Benthos* BUI. Delisting criteria for this BUI therefore requires revision to reflect current science, and account for the Canada-Ontario sediment management framework being applied to Areas of Concern as the means to assess benthic conditions.

### 4.0 Changes since the Stage 1 and Stage 2 RAPs:

The Stage 1 RAP (1992) and Stage 2 RAP (2002) reports identified benthic invertebrate impairment existed within industrial discharge areas and up to 24km downstream of these areas. In order to understand the state of the benthic community within the AOC, numerous investigations have been conducted. These investigations have covered the following areas: Algoma Boat Slip, Algoma Slag Dump, Transport Canada Water Lot, Lake George Channel, Little Lake George, Lake George, Bellevue Marine Park and surrounding area (Figure 1). These investigations – as documented in the Conceptual Site Model (Ramboll, 2020) – have shown that the benthic invertebrate community within the AOC has largely recovered over the last 30 years. There is, however, evidence of benthic toxicity in localized areas east of Bellevue Marine Park, within the Algoma Boat Slip (before it was dredged in 2017-2019), and within the Transport Canada water lot. Each site has its own unique characteristics, contaminants of concern, and ownership. Thus, the proposed BUI delisting criteria include specific requirements for these three locations, in addition to having an AOC-wide delisting criteria.



Figure 1: Contaminated Sediment Investigations within the St. Marys River AOC.

# 5.0 Proposed Updated Delisting Criteria with Supporting Rationale:

The *Degradation of Benthos* BUI will no longer be impaired when:

- Assessments of St. Marys River sediment using multiple lines of evidence (sediment chemistry, benthic community alteration, toxicity, and biomagnification potential) conclude negligible environmental risk<sup>1</sup> requiring no further management action, as demonstrated under the *Canada-Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment*.
- And for these specific sites, the following criteria need to be met:
  - The contaminated sediment in the Algoma Boat Slip is: i) assessed, ii) removed through dredging (down to native material/point of refusal), and iii) reported upon post-cleanup. This shall be done in a manner consistent with the Legacy Environmental Action Plan (LEAP) agreement between Algoma Steel and the Province of Ontario, which requires source track-down investigations and a recourse should contaminants redeposit at elevated concentrations; and
  - Assessments using multiple lines of evidence (sediment chemistry, benthic community alteration, toxicity, and biomagnification potential) on the area east of <u>Bellevue Marine Park</u> and the <u>"Transport Canada Water Lot"</u> conclude negligible environmental risk<sup>1</sup> requiring no further management action, as demonstrated under the *Canada-Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment*. If there is environmental risk requiring management action, evidence of successful implementation of management action as indicated

<sup>&</sup>lt;sup>1</sup> The use of the term "Negligible Environmental Risk" is in reference to the *Canada-Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment* and is in context to what is described therein. Its use is explained in more detail under sections 6.0 and 7.0.

by improving trends over three monitoring cycles and as determined through expert technical review – will be required for BUI re-designation.

# 6.0 Supporting Rationale:

The overarching delisting criteria regarding the evaluation of St. Marys River sediment and benthic communities through multiple lines of evidence – as prescribed under the *Canada-Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment* – ensures the use of an ecosystem approach to sediment assessment, and considers potential effects on sediment-dwelling and aquatic organisms, as well as potential for contamination to accumulate in the food chain. The Framework is intended to standardize the decision-making process for contaminated sediment management in Great Lakes Areas of Concern while also being flexible enough to account for site-specific considerations. To determine what is "negligible environmental risk requiring no further management action", as per the delisting criterion, the Framework follows a multiple step process to evaluate these lines of evidence and conclude whether or not there is negligible environmental risk, and whether or not further management action is required – Figure 2.

The first sub-delisting criterion target of ensuring effective dredging of contaminated sediment in the Algoma Boat Slip, with the conditions assessed and reported upon before and after the dredging, is consistent with the recommended remedial and monitoring actions under the 2002 Stage 2 Remedial Action Plan report (i.e., Action NPS-5)<sup>2</sup>. And, it is consistent with the Legacy Environmental Action Plan (LEAP) agreement signed between the Ontario Ministry of Environment, Conservation and Parks and Algoma Steel, which outlines general objectives and identifies the Algoma Slip as one area of focus.

The second sub-delisting criterion of having the area East of Bellevue Marine Park and the "Transport Canada waterlot" being evaluated through multiple lines of evidence – as prescribed under the *Canada-Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment* – ensures the use of an ecosystem approach to sediment assessment as applied to all parts of the Canadian side of the St. Marys River AOC, but with focus on the two locations requiring further assessment.

<sup>&</sup>lt;sup>2</sup> As written in the 2002 Stage 2 RAP report (page 56) the action to be satisfied is:

**Action NPS-5:** Evaluation of Algoma Slip Sediment and Implementation of Clean-up Implementing Organizations: Algoma Steel Inc., EC, OMOE

The Algoma Slip sediment quality and quantity needs to be evaluated from an environmental perspective and remediated as required. This need is addressed in the three party EMA signed by ASI, EC, and *OMOE*, which includes among its objectives "the de-listing of the 'beneficial use impairment' associated with the ASI boat slip as identified in the Stage 1 report for the Remedial Action Plan (RAP) for the St Marys River." To achieve this, Algoma has agreed to: (a) assess sediment contamination and submit a clean-up plan to *OMOE* in its Feb 1, 2001 semi-annual report, and (b) complete the clean-up and submit a summary report to *OMOE* in its first semi-annual report following completion of the work.

# 7.0 Understanding the Decision Making Framework

The *Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment* uses an ecosystem approach to sediment assessment and considers potential effects on sediment-dwelling and aquatic organisms, as well as potential for contamination to accumulate in the food chain. It is intended to standardize the decision-making process while also being flexible enough to account for site specific considerations.

Under the Framework, individual decision points initially comprise relatively simple "yes" or "no" criteria. The integrative decision point for sediments that cannot be so readily assessed, is a weight of evidence matrix framework combining up to four main lines of evidence. Coincidentally, these lines of evidence capture many of the same considerations called for in the Stage 2 RAP report delisting criteria. The four lines of evidence are:

- <u>Chemistry</u>: Typically chemistry data (e.g., concentrations of contaminants such as metals, PAHs, PCBs) is used to characterize a site. The Framework uses these data in an initial pre-screening step to remove sites from further consideration if concentrations are below appropriate sediment toxicity thresholds, and helps provide a good reference for changes over time.
- <u>Toxicity</u>: The Framework looks at toxicity as a measurement of the negative impacts of contaminated sediments on benthic invertebrates (e.g., survival, growth, reproduction). A determination is required to assess if the contaminated sediments are toxic to individual organisms, and the extent of any toxicity.
- <u>Benthic community alteration</u>: It is important to determine benthic community impairment by comparing the AOC site to appropriate Great Lakes reference sites. This refers to the community of organisms living in or on the sediments of aquatic habitats. Alteration in the benthic community (e.g. abundance, diversity, dominance) may be related to contaminated sediment but may be due to other factors as well, such as differences in predation or competition.
- <u>Biomagnification potential</u>: Biomagnification is defined as the uptake of a contaminant through a food chain resulting in increasing concentrations through three or more trophic levels. Examples of contaminants that may biomagnify include organic mercury, polychlorinated biphenyls (PCBs), and 2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD). The Framework uses conservative modeling (i.e. worst case scenario assumptions) to determine whether or not biomagnification is a concern. If so, more site-specific assessments are required.

### **Negligible Environmental Risk**

The Framework evaluates these four lines of evidence through a multi-step process (Figure 2). The results from these evaluations help to determine whether there is negligible environmental risk based on a weight of evidence approach (see Table 1 in Appendix) and through the decision-making matrix (Table 2 in Appendix).

### **Deeper Sediments**

Typically, the Framework is applied to surficial sediments (i.e., top 10cm) because that is where benthic organisms live. Surficial sediments may effectively cover deeper sediments, which may be similarly or differently contaminated. However, the possibility that deeper sediments may be uncovered as a result of natural processes or human activity is also investigated under the Framework. Such studies involve assessments of both sediment stability and sediment deposition rates.

If deeper sediments are contaminated, and could be uncovered, they could pose an environmental risk. If the sediments are not likely to be uncovered, i.e., to become surface sediments, under any likely set of circumstances, then they do not require further assessment as any contaminants they contain will remain buried and there will be no exposure routes to biota. The Framework also follows the general rule that if the impacts of a remedial alternative will cause more environmental harm than leaving the contaminants in place, that alternative should not be implemented.

### Figure 2: Steps and Lines of Evidence of the Canada Ontario Decision Making Framework for Assessment of Great Lakes Contaminated Sediment (2008)



### 8.0 U.S.-Michigan Delisting/Restoration Criteria and Assessment:

The Degradation of Benthos BUI will be considered restored when:

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

OR, in cases where MDEQ procedures are not applicable and benthic degradation is caused by contaminated sediments.

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

In Sault Ste. Marie, Michigan the site of the former tannery at the Tannery Bay/Cannelton site had remedial dredging completed in 2007, and the former Manufactured Gas Plant site had dredging and disposal remedy completed in 2011.

# 9.0 Recommended Remedial and Monitoring Actions from the Stage 2 RAP:

The Stage 2 RAP report (2002) recommended the following remedial and monitoring actions to restore the *Degradation of Benthos* BUI:

Action NPS-1:	Development of a multi-agency sediment management plan (UNDERWAY).
Action NPS-2:	Conduct further studies to characterize sediment quality in high priority areas (UNDERWAY).
Action NPS-3:	Completion of the St. Marys River contaminated sediment zones evaluation (COMPLETE)
Action NPS-5:	Evaluation of Algoma Slip sediment and implementation of cleanup (UNDERWAY)
Action PSM-1:	Long-term water monitoring at the Cannelton Industries site (NOT APPLICABLE – Michigan Action)
Action PSM-6:	Monitoring receiving water at St. Marys Paper (NO LONGER APPLICABLE)
Action NPSM-1:	Monitoring East End Wastewater Treatment Plant and identification of upstream sources (NO LONGER APPLICABLE)
Action NPSM-3:	Biological Monitoring at the Cannelton Industries site to ensure protection of the ecological food chain (NOT APPLICABLE – Michigan Action)
Action NPSM-5:	Re-sampling of river sediments to obtain trend information (UNDERWAY)

Action NPSM-6: Benthic, toxicity, and sediment chemistry at Bellevue Marine Park (COMPLETE)

## **10.0 References**

- Environment and Climate Change Canada (ECCC), United States Environmental Protection Agency (USEPA), Ontario Ministry of the Environment, Conservation and Parks (MECP), and Michigan Department of Natural Resources (MDNR). 2002. The St. Marys River Area of Concern Remedial Strategies for Ecosystem Restoration. Stage 2 Report. 140 pp.
- Ontario Ministry of the Environment, Conservation and Parks (MECP) and Michigan Department of Natural Resources (MDNR). 1992. The St. Marys River Area of Concern: Environmental Conditions and Problem Definitions. Remedial Action Plan Stage 1. 444 pp.
- Environment and Climate Change Canada (ECCC). 2018. Great Lakes Areas of Concern 2018 Summary of Beneficial Use Impairment (BUI) Status and Delisting Criteria for Canadian Great Lakes Areas of Concern.
- Environment and Climate Change Canada and Ontario Ministry of the Environment, Conservation and Parks. 2008. Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment. ISBN 978-0-662-46148-7
- http://bpac.algomau.ca/wp-content/uploads/2015/09/Canada-Ontario-Decision-Making-Framework-for-Assessment-of-Great-Lakes-Contaminated-Sedmient-2008.pdf

Ramboll. 2020. Conceptual Site Model and Recommendations: St. Marys River Sediments. Revision 7.

United States Environmental Protection Agency (USEPA). 2012. Final Remedial Action Report, Great Lakes Legacy Act, Sediment Remediation Project. Prepared by CH2M HILL, Ecology and Environment Inc., Environmental Design International Inc., and Teska Associates Inc. AW No. 155-RARA-2515/Contract No. EP-S5-06-01. http://bpac.algomau.ca/wp-content/uploads/2016/03/SSM RAR Final-Report-2012.pdf **Appendix: Canada-Ontario Decision Making Framework**