

**Prepared in cooperation with the**

U. S. Environmental Protection Agency  
New York State Department of Environmental Conservation

**Prepared in collaboration with the**

St. Regis Mohawk Tribe at Akwesasne

## Sediment toxicity and status of benthic invertebrate communities in the St. Lawrence River and its tributaries within the Massena Area-of-Concern

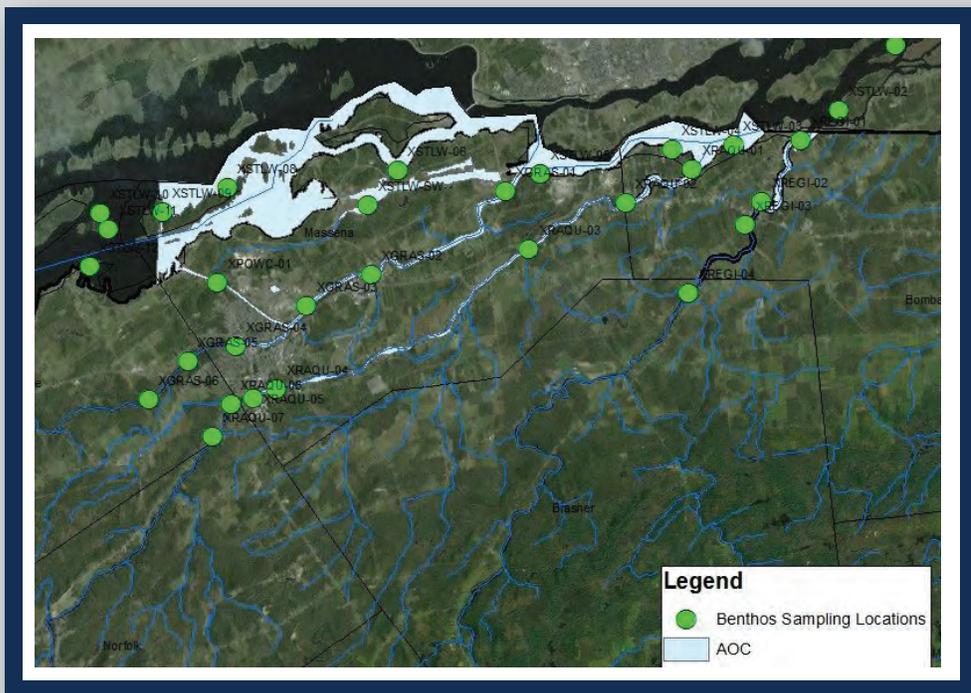
*The results of standardized toxicity tests, using *Chironomus dilutus*, and the condition of macroinvertebrate assemblages from bed sediments collected at sites from both inside and outside the St. Lawrence River at Massena Area of Concern will help determine if the benthos beneficial use is currently impaired or not.*

**Background**

Past water-quality issues in the St. Lawrence River at Massena, NY resulted in a determination that selected beneficial uses were impaired in a surrounding Area of Concern (AOC) and on the Canadian side of the international boundary (Cornwall, Ontario). The benthic macroinvertebrate community or “benthos” Beneficial Use Impairment (BUI) was designated degraded because impairment metrics were unavailable or

inconclusive. Recent sampling efforts by [New York State Department of Environmental Conservation \(NYSDEC\)](#) as part of their Rotating Integrated Basin Studies (RIBS) program indicate that macroinvertebrate communities in some sections of the St. Lawrence River and its tributaries in the Massena AOC are not impacted or only slightly impacted. Thus, the BUI for benthos may be outdated in parts of the Massena AOC. The primary goal for the Massena (and Cornwall)

Remedial Action Plan (RAP) (developed by the NYSDEC, the Massena Citizen Advisory Committee (CAC), the Canadian governments, the Cornwall Public Advisory Committee (PAC), and the [St. Regis Mohawk Tribe at Akwesasne](#)) is to “restore, protect, and maintain the chemical, physical, and biological integrity of the St. Lawrence River ecosystem and in particular the Akwesasne, Cornwall-Lake St. Francis and Massena AOC in accordance with the Great Lakes Water Quality Agreement and other agency laws, regulations, and policies”. The RAP established specific criteria in the St. Lawrence River at Massena AOC for delisting (restoring and protecting) the “Degradation of Benthos” BUI. These criteria are: (1) “Benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics”, and (or) (2) “In the absence of community structure data, the toxicity of bed sediment-associated contaminants is not significantly higher than controls at unimpacted sites.” Detailed background information on the [St. Lawrence River at Massena AOC](#) and the RAP can be found in the report, “St. Lawrence River at Massena, New York Remedial Action Plan Status Report: January 2006”. More comprehensive information on the status of benthic communities and toxicity of bed sediments are needed inside the St. Lawrence River at Massena AOC and at unaffected reference (control) sites to determine if one or both delisting criteria have been achieved in the AOC.



Sediment sampling locations inside and outside the St. Lawrence River at Massena NY AOC.

## Objectives

The objective of this study is to determine if the benthos beneficial use is, or is not impaired in parts of the St. Lawrence River at Massena NY AOC. Benthic macroinvertebrate community data and bed sediment-toxicity test results will be used specifically to test whether bed sediments in the St. Lawrence River at Massena AOC meet established criteria (see above) for delisting the benthos BUI.

## Approach

The approach of this study will be to generate bed sediment toxicity and benthic community data needed to test two related hypotheses that address the two criteria for delisting the benthos BUI. The first hypothesis is that bed sediments at selected sample locations in the AOC (in three tributaries and in the

St. Lawrence River) are no more toxic to the test species than bed sediments collected from control sites located outside (generally upstream from) the AOC. Acute (survival) and chronic (growth) whole bed-sediment toxicity tests will be conducted using the midge (*Chironomus dilutus*), following standard [USEPA methods](#). The second hypothesis is that the benthic macroinvertebrate communities from targeted sites within the AOC are not significantly different, or are affected (impacted) no more seriously than the communities encountered at reference (control) sites located outside the AOC according to spatial patterns in benthic community composition (nonparametric ordination) and the Biological Assessment Profile (BAP) index and component metrics for Ponar samples collected from soft bed sediments developed by NY State Department of Environmental Conservation. The component metrics of the BAP include: SPP (species richness), HBI (Hilsenhoff Biotic Index), DOM3 (Dominance-3), PMA

(Percent Model Affinity), and DIV (species diversity). The scores from the five indices are converted to a common 0-10 scale. The mean score of the five indices denotes the overall BAP and associated impact for each site. A Petite Ponar sampler will be used to collect 5 replicate macroinvertebrate-community samples and a single composite sample for bed sediment toxicity tests at each study site. Statistical analyses and multivariate (ordination) methods will be used to test the two hypotheses and to determine if the bed sediments within the St. Lawrence River at Massena AOC meet either criterion for delisting the benthos BUI.

## Sieving sediments for macroinvertebrate sample



## Sediment toxicity-test organism: *Chironomus dilutus*



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