

**Charge to the
Science Advisory Board**

For the Consultation of:

LAKE ERIE PHOSPHORUS OBJECTIVES

**Prepared by the
EPA Region 5 Water Division**

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Background

The U.S. Environmental Protection Agency (EPA) Region 5 is co-leading a binational workgroup to develop and implement the Nutrients Annex (“Annex 4”) of the 2012 Great Lakes Water Quality Agreement (GLWQA) in accordance with Article 3(b) of the GLWQA. Under Annex 4, the U.S. and Canada (herein referred to as “the Parties”) are charged with establishing binational Substance Objectives for phosphorus concentrations, loading targets and allocations for the nearshore and offshore waters of Lake Erie by February 2016. While the Annex applies to all Great Lakes, only Lake Erie has time-bounded commitments, reflecting the Parties’ commitment and understanding of the need for prompt action to combat the algae issue there.

Lake Ecosystem Objectives

Pursuant to Article 3(1)(b)(i), the Parties adopted the following Lake Ecosystem Objectives related to nutrients for Lake Erie:

1. minimize the extent of hypoxic zones associated with excessive phosphorus loading,
2. maintain the levels of algal biomass below the level constituting a nuisance condition;
3. maintain algal species consistent with healthy aquatic ecosystems in the nearshore;
4. maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health; and
5. maintain mesotrophic conditions in the open waters of the western and central basins of Lake Erie, and oligotrophic conditions in the eastern basin of Lake Erie.

The Annex 4 workgroup has adopted the following general approach for establishing new/revised Substance Objectives and loading targets for Lake Erie:

- 1) establish eutrophication response indicators and metrics related to the nutrient Lake Ecosystem Objectives (LEOs);
- 2) use multiple models to compute appropriate load-response relationships and attribute these to the eutrophication response indicators of concern;
- 3) synthesize and interpret the results of the ensemble of models to derive phosphorus concentrations and loading targets needed to meet the nutrient LEOs, taking into account the bioavailability of various forms of phosphorous, related productivity, seasonality, fisheries productivity requirements, climate change, invasive species and other factors, such as downstream impacts, as necessary;
- 4) apply an adaptive management approach in which the phosphorus concentrations and loading targets are revisited periodically.

Due to the complexity of the issue and the need to rely on existing information in the short term, we anticipate refinements in response to peer review and stakeholder feedback. Ongoing monitoring and evaluation will be critical as we track the changes in phosphorus concentrations and loads, in addition to other drivers like hydrology and climate, and the ecological response.

Additional Resources: The EPA identified several reports as supplementary material on the efforts taken in the Lake Erie basin to better understand the background and context of this work. These three reports provide additional background information on the efforts to understand and manage excess nutrients in Lake Erie and the preliminary work on approaches to develop phosphorus objectives:

- [Lake Erie Binational Nutrient Management Strategy: Protecting Lake Erie by Managing Phosphorus](#). Prepared by the Lake Erie LaMP Work Group, 2011.
- [Status of Nutrients in Lake Erie Basin](#). Prepared by the Lake Erie LaMP Work Group, 2009.
- An Approach for Determination of Phosphorus Objectives and Target Loads for Lake Erie. Discussion paper prepared by LimnoTech for Environment Canada, May 2013.

Charge to SAB:

The EPA requests Science Advisory Board (SAB) provide early advice on the approach (Phase I consultation) and subsequent review (Phase II Peer Review) of preliminary binational phosphorus objectives, loading targets and allocations for the nearshore and offshore waters to achieve the Lake Ecosystem Objectives related to nutrients for Lake Erie, pursuant to the Annex 4 of the 2012 GLWQA.

The objective of the SAB consultation is to obtain early advice on the modeling approach being applied to inform the updated phosphorus targets for Lake Erie. The purpose of the subsequent review of the preliminary phosphorus targets will be to obtain advice on (1) whether the process used to develop the targets was appropriate to meet the nutrient Lake Ecosystem Objectives as defined in the GLWQA (2) whether the recommended targets reflect the best available information on the phosphorus sources and trophic status of Lake Erie. EPA and Environment Canada are particularly interested in advice pertaining to future applicability of this work as we develop a phosphorus reduction strategy for Lake Erie and begin evaluating phosphorus targets for other Great Lakes.

Document for Review: The SAB will review the methodology presented in EPA's *Draft Technical Approach for Lake Erie Phosphorus Load-Response Modeling*. The document describes the framework approach the EPA will use to model eutrophication response indicators, the ensemble of models relevant to Lake Erie, and the available data to develop, calibrate, and validate the models.

Phase 1 Consultation Questions:

1. Please comment on whether the eutrophication response indicators proposed sufficiently address and provide the scientific foundation for the Lake Ecosystem Objectives for Lake Erie. During your evaluation of the eutrophication response indicators, identify other metrics appropriate for measuring eutrophication response in Lake Erie and other Great Lakes that should be considered, and whether there is a method (model) available to measure this response.
2. Please comment on each of the models chosen to evaluate the eutrophication response in Lake Erie? Are the models appropriate for representing the eutrophication response indicators? Do the models reflect the best available scientific knowledge?
3. Please comment on the appropriateness of the ensemble modeling approach to examine the suite of eutrophication response indicators. Are the models included in the ensemble, when used either singly or combined, sufficient to provide a scientifically grounded basis for the required update of phosphorus load targets for Lake Erie?

4. An anticipated outcome of the modeling exercise is to better understand and quantify what types of conditions would be expected in the lake based upon different levels of phosphorus loading, and to use that information to inform selection of phosphorus loading targets needed to meet the nutrient Lake Ecosystem Objectives. The phosphorus loading targets could be converted to concentration targets, particularly for river mouths/nearshore zones. Please comment on efficacy and value of establishing target values for both phosphorus loads and concentrations in order to meet to the Lake Ecosystem Objectives. How can we ensure the phosphorus concentration and loading targets are internally consistent with respect to the eutrophication response indicators of concern?