Exhibit A
International Upper Great Lakes Study – Sub-Product Reviews, Synthesis Product Reviews, and Draft Final Study Report Reviews Template

Peer Review of Manuscripts

This manuscript has been submitted for independent peer review to the Co-Chairs of the Independent Peer Review Group (IRG) as identified in the Independent Review Plan (IRP) of the International Upper Great Lakes Study (IUGLS).

The evaluation and acceptance of the technical report (documentation) will include, as part of the review criteria, how effectively the goals of the work have been accomplished within the limits as described in the "background and context statement in Article 9.3.1.2.

Manuscripts shall be evaluated on the extent to which the authors' efforts have been covered/documented and the extent to which the reviewers can answer the review questions:

- Are the methods employed by the authors sufficient to answer the questions;
- are they being used correctly;
- are the analyses and tests appropriate for the problem at hand; and
- are the derived conclusions supportable by the model and analyses?
- Are there any other comparable methods or approaches that may/ought to be considered, which would provide more insight for the specific task under review?

Checklist for the Reviewer

Your review is:

- To provide the authors with directions as to how they could improve their analysis and technical report. Please provide clear instructions and comment objectively, remembering the efforts that they have made to prepare the manuscripts. On a separate sheet, you may provide comments for the editor that you feel are necessary. These separate comments will not be provided to the authors.

Some additional points are:

- Please document statements adequately so that authors may fully understand your concerns. You may do this using additional sheets cross-referencing your additional comments to the specific questions below.
- Some of the questions follow a scale of 1 through 5, with 1 be the highest rank (yes -- always or excellent) and 5 being the lowest (no -- never or very poor). Please encircle your responses.

Manuscript: Statistical and Spatial Analysis of Bathymetric Data for the St. Clair River, 1971–2007

Author(s): Bennion, D.

Name of Reviewer: Colin Rennie

1. Are the objectives of the work clearly stated? 1 2 3 4 <u>5</u>

2. Are the methods employed valid, appropriate and sufficient to address the questions, hypotheses or the problem? 1 2 3 <u>4</u> 5

I question the uncertainty analysis.

3. Are the observations, conclusions and recommendations supported by the material presented in the manuscript (e.g., data, model and analyses)? 1 2 3 4 <u>5</u>

4. Are the assumptions used valid and are the mathematics presented correct? 1 2 <u>3</u> 4 5

I question the uncertainty analysis.

5. Is the manuscript well organized, material precise and to the point, and clearly written using correct grammar and syntax? 1 2 3 4 <u>5</u>

6. Are all of the figures and tables useful, clear, and necessary? 1 2 3 4 <u>5</u>

7. What is the quality of the overall work? 1 2 3 <u>4</u> 5

Recommendation (please circle your response)

A - acceptable
<u>B</u> - acceptable with suggestions for revision
C - acceptable if adequately revised
D - unacceptable

If you have selected **C**, do you wish to receive the revised manuscript for further review? yes no

Rating (Circle the rating you would like to give this manuscript. Unacceptable work should be given a score of 40 or less.)

100 90 80 <u>70</u> 60 50 40 30 20 10 0

Comments (limit responses to one paragraph for each question; reference pages, charts, and data. Please distinguish if responses are of major or minor concerns.)

Please see detailed review below, which addresses these questions.

A. What is the best/most unique part of the analysis?

Thorough analysis of change in channel based on both interpolated and raw data.

B. What is the most critical aspect of the study/analysis? Why?

Comparison of channel morphology for different survey years, and assessment of uncertainty in channel change estimates based on uncertainty of available bathymetry.

C. Which aspect of the analysis/modeling is weakest? Why? How can it be improved?

The uncertainty analysis appears to be excessively conservative (see below). Modifying the uncertainty analysis may lead to finding significant changes in channel bathymetry between survey years.

D. Are there any other suggestions that are related to how this analysis may be used more effectively or the results explicated in a more understandable manner?

Please indicate any confidential comments to the Co-Chair(s) of the Independent Peer Review Group in the space below. Comments for transmission to the author(s) should be on a separate sheet attached.

Signature: Signature:  Date: June 24, 2009

Comments for Transmission to Authors

It would be useful to have both general comments and specific comments for major and minor revision. Please use additional sheets should they be required.

Bennion, D., 2009, "Statistical and Spatial Analysis of Bathymetric Data for the St. Clair River, 1971–2007", USGS Scientific Investigations Report 2009–5044.

Summary

The Bennion (2009) study assessed changes in St. Clair River bathymetry based on available survey data since 1971. In general, the study was performed well, although there appears to be a key weakness. The study found no statistically significant change in bathymetric volume between survey years (Table 7). The author used a conservative method to assess uncertainty of change in bathymetry between survey years by summing all sources of uncertainty. It is possible that a more statistically valid pooling of uncertainty sources would lead to findings of statistically significant volume change. This would be an important finding, given that a primary objective of the IJC study is to determine whether changes in conveyance have caused reduction in lake water levels.

Review

The author has provided a detailed and thorough review of available bathymetry data, survey and interpolation uncertainty, and estimation of channel change. This reviewer had only a four questions/concerns, as specified below.

Survey data

p.4 It was surprising to read that the author was unable to determine the survey data binning procedure for the 2000 survey. Given that this survey occurred only nine years ago, one would assume that the original surveyors could be contacted to elucidate the survey and binning methods.

Interpolated Bathymetry

p.4 The author utilized ordinary kriging in blocks, such that interpolated sections of river were relatively straight, which probably improved the interpolation because measured variogram anisotropy was consistent for a block. It would have been useful to see figures of measured and modelled variograms (perhaps as appendices), which would assist in the evaluation of the interpolation.

No plots of the interpolated bathymetry were provided. These would have been useful for the reader to assess the geomorphic importance of locations of bathymetric error and locations of volume/elevation change.

Statistical Evaluation of Cut/Fill

p.6 The author has utilized an extremely simple uncertainty model to calculate errors in cut/fill estimates. The model can be written as:

$$\varepsilon_{cf} = (\varepsilon_b + \varepsilon_a) n A$$

where ε_{cf} is the uncertainty of the estimate in the total change of section volume, ε_b is the uncertainty of elevation at a cell in the initial (before) survey, ε_a is the uncertainty of elevation at a cell in the initial (after) survey, *n* is the number of cells in the comparison, and A is the area of a cell. The cell uncertainties were calculated by adding the mean absolute interpolation error to the average measurement (survey) error for a given survey.

This model adds all errors linearly, which appears to the reviewer to be excessively conservative. A typical error model would pool the variances due to error sources (i.e. take the square root of sum of square errors). This is because a linear combination of random variables has variance $\sigma^2 = \sum_i a_i^2 \sigma_i^2$ (Harris 1966), where σ_i is the variance of random variable *i*, and a_i is the coefficient for random variable *i* in the linear model. Assuming all a_i in the error model equal 1, then the variances of each error term are summed, and the square root is taken to yield a standard deviation (standard error). If errors are not normally distributed, it is also worthwhile to conduct a Monte Carlo simulation with full distributions of each error term to estimate a probability distribution for ε_{cf}. Importantly, the pooled variance results in an error estimate less than simply summing all error sources.

This is an important issue, because no estimates of volume change were found to be statistically significant due to the large uncertainty estimates (Tables 7). If the estimated uncertainty were reduced, possibly statistically significant volume changes would be found.

The author then proceeds to utilize only grid cells that had changes in elevation exceeding the estimated uncertainty (Table 8). While this masking approach reduces the influence of survey noise from the analysis, it is not clear to the reviewer if the observed changes in volume are considered to be statistically significant.

Ultimately, the author utilizes direct comparison of surveyed points to identify locations of significant elevation change. In general, as one might expect, there has been degradation on outer bends and aggradation on inner bends in the upper channel. Furthermore, these results suggest that the river bed degraded between 1971 and 2000, and aggraded between 2000 and 2007 (Appendix Figures 31-36).