

## E. Loucks Comments and Study Response

Page	Location	Comment
ii	Finding 1	<p>The declines of 62 and 23 cm are estimated medians and should be expressed as ranges. The apparent decline is different during periods of high and low supply</p> <p>The text in the report is revised to concentrate only on the period from 1963 to 2006, which is the Study timeframe.</p> <p>The first column is too narrow and causes the numbers to wrap around. Many of the figures and tables in the draft report are not publication ready. The reviewer assumes that editors will correct these issues but sometimes it is difficult to hold such comments</p>
19	Table 2-1	<p>All figures and tables have been upgraded to the higher quality and consistency.</p> <p>The footnote refers to chart datum which is not defined until Figure 2-1. Add “or the connecting channels” to the foot note.</p>
19	Table 2-1	<p>The chart datum is now defined on the same page it is first used.</p> <p>Say “Lake Ontario to Montreal” rather than the reverse as this is the direction of flow</p>
19	Figure 2-1	<p>The graphic has been revised to respect the flow direction.</p> <p>Being “difficult to determine” is not a sufficient argument for considering thermal expansion to be negligible. Later in the report, thermal expansion is given as a source of significant error in residual method supplies.</p>
22	1 <sup>st</sup> Para.	<p>The text and logic have been revised to reflect this observation.</p> <p>The residual method and the component method are equally simple. Both methods have challenging data acquisition and estimation issues. One method is based on climatological inputs and the other is based on measuring system response</p>
22	3 <sup>rd</sup> Para.	<p>The Study agrees with the reviewer's observation on the differentiation.</p> <p>Either here or in Chapter 3 or 6 there should be some discussion of the difficulties presented by hydrologic recycling.</p>
22	3 <sup>rd</sup> Para.	<p>With the type of existing modelling tools (GLERL's Large Basin Runoff Model) it is indeed challenging to obtain an estimate of hydrological recycling; that is, water evaporated from the lake appears as precipitation within the basin catchment. With the research the Study is supporting in the second part, these tools may be capable to isolate and quantify this recycling component.</p> <p>The sentence “Over the long term, NBS limits the amount of water that can be stored in or released from a Lake” is unclear and inaccurate.</p>
27	2 <sup>nd</sup> Para.	<p>The Study believes what is noted in this chapter to be a fair statement considering unregulated Lake Michigan-Huron and Lake Erie fluctuate within a 1.9 m and 1.4 m respectively. This is consistent with the uncontrolled flow through the system. The average flows in the connecting channels generally reflect, for example, the inflow from upper connecting channel and the computed Net Basin Supplies. This supports the above assertion.</p>
28	7 <sup>th</sup> line	<p>Try to avoid using the possessive “lake’s”</p>

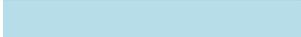
		This has been corrected.
31	Last Para.	In the scheme of things, the Great Lakes Basin is not particularly complex and to say “highly complex” might be sensationalizing the issues
		The text has been revised.
33	Figure 2-5	These are not hydrographs; the term is strictly limited to flow. The scales on these plots are not readable
		The figure caption was revised to indicate these are water level graphs. The quality of the graph has been improved.
35	Figure 2-6	This figure contains a lot of poor formatting including some entirely nonreadable text between 3500 and 4000 YA. The inset appears to be very important and should be presented as a separate figure.
		The figure was replaced with a better quality graph that makes the inset stand out and a separate figure is not necessary. The figure is now readable.
35	Figure 2-6	Below the figure there is a note that includes important conclusions. Perhaps this discussion should be worked into the main text
		The information below the graph was worked into the body of the text in the final report.
36		Many of the gauges and connecting channels of interest appear to lie in the region of zero adjustment in Figure 2-8. While this is discussed later in the report, it may be worth mentioning the measurement difficulty and spatial variability of Isostatic rebound.
		The Study recognized that the treatment of GIA related issues did not receive due consideration at the draft report stage. The final report was redesigned to address all geotechnical aspects of GIA, the challenges in its estimation and its impacts in recorded water levels. A new chapter (Chapter 6) in the final report addresses these questions.
37	Figure 2-8	The units of the numerical data are not provided (cm/century)?
		The units have been added on the map.
38		As I read the report, I found the Baird Report Hypotheses section to be out of place in Section 2.3
		The Study agrees with the reviewer's observation on this subject and has revised the text in this section.
43	1st Key Point	Again, in my opinion, terms such as vast and complex overstate the situation. Due to the large volumes stored in the Lakes, the Great Lakes are naturally self-regulating
		The Study agrees with the reviewer's observation on this subject and has revised accordingly.
47	Equation	I don't find this quasi-mathematical expression to be helpful in furthering understanding for either scientists or non-scientists. The concept should be expressed algebraically, graphically or in English words.
		In the final report a consistent narrative, explaining hydraulics, GIA and hydroclimatology, is developed through a table that accounts for all the factors.
47	Data Challenges	This section alludes to a lack of data several times despite this being one of the most studied systems on earth. How many watersheds have their own scientific journal?

		The Study agrees with the reviewer's observation on this subject; nevertheless, important data issues remain. The fact that there have never been hydrometric gauging stations on the interconnecting channel highlights this issue.
49	10th line	I wouldn't characterize the number of meteorological stations as "very limited" though admittedly sparse in Northern Ontario. I do recall there are long records at Bracebridge and Parry Sound
		The text has been revised to reflect the challenges with the declining number of monitoring stations.
55	Table 3-2	Project 3 should read ...Standardized HEC-RAS Model.
		The tables in this chapter have been revised to reflect this.
57	1st line	This discussion should be more precise in differentiating between the models developed for the study versus the modeling software developed by the HEC.
		The wording has been changed to reflect this.
59	Table 3-3	The project title for projects 18 and 19 use the word affect where effect is intended.
		Table has been modified.
62	Figure 3-4	Each of the three stud trains is formatted differently. Some of the boxes contain unreadable text
		Graphic has been revised for consistent format and legibility.
65	2nd Para	"mid-lake" has an unintended meaning and is a new term. Middle lakes model would be better and should be defined.
		The term "mid-lake" is an established nomenclature among the Great Lakes practitioners and the Study has retained this definition.
67	3rd Para	Instead of "and approved," I would prefer to say "followed by a process to resolve all comments and concerns of the reviewers."
		The text has been revised.
86		Fontana is italicized and Martin is not
		The text has been revised.
92	Footnote	Isn't Pa the abbreviation Pascals, the common SI unit for stress or pressure?
		The text has been revised.
93	Figure 4-14a	The scales of these two maps should be provided. Larger maps would be more helpful.
		The maps have been revised for size and legibility.
104	footnote	The Reynolds number, not the Froude number, is used to identify laminar flow. The flow in the St. Clair River is most certainly turbulent, not laminar. What is meant here is subcritical flow which is sometimes also called quiescent flow
		The distinction is noted. Only Froude Number is now defined and used.
	4th	A Froude number greater than unity would create a critical flow control section. A Froude number of one would just be a lot of unstable flow so the text is slight misleading. The term control section is also used at locations such as the Blue Water Bridge pinch point where there is no critical flow.
104	paragraph	The text has been revised to address the points related to control section, reach control, etc.

105	Equation 1	The Manning Formula is usually written with the subscript f on the slope to signify that S is the slope of the EGL (the friction slope). I recommend stating the formula for conveyance as well and pointing out that it depends only on the channel geometry and the depth of flow. This section is about conveyance, it should be featured here. All the terms of the standard Manning formula are defined with their dimensions. The slope is defined as the energy grade, which is same as water surface slope and bed slope for uniform flow situation. The weakness and extension of Manning formula in variable flow and unsteady flow situation is acknowledged and the text has been revised.
105	Last line	The S in the Manning formula is not the channel slope, particularly in this context. As noted above it is defined on the energy grade line as used in the Bernoulli's definition.
112	Figure 5-4	The parameters that are graphed in these figures are unclear from the figure titles. The units of the y axis are not provided. Graphic has been revised for consistent format and for legibility.
113	2nd Para	The purpose of italicizing some of the text is unclear. It begins in the middle of a word. The text has been revised.
113	3rd Para	Why "Up to 69 percent?" Wasn't this the percentage of data pairs that showed an increase? The text has been revised.
117	Figure 5-7	Same problems as with Figure 5-4 Graphic has been revised for consistent format and for legibility.
127	Table 5-4	The title of this table is confusing: Model and simulated are redundant, aren't both data sets averages? SSB71 is not defined The title has been revised and the term SSB71 is now defined in Table 5-4 in the final report.
129	Table 5-5	Why is extra precision indicated on the Survey error? The table has been revised to better reflect the level of precision.
144	2nd Para	The explanation in this paragraph is difficult to follow. Suggest developing a graphic of matrix that illustrates the interrelationships among outlets and water levels The information has been enhanced with a chapter solely addressing GIA. A number of charts and graphs along with explanatory text have been provided in the final report.
145	Figure 5-24	As noted previously, the units of measure used in this figure should be indicated The units have been added on the map.
148	5th Para	The stated decline in fall from 2.9 m to 1.9 m does not equal 80 cm. Why the discrepancy? The text has been revised.
149	5th Para	There is an extra parentheses symbol before NBS The chapter on Hydroclimatology has undergone major revisions. The extra parenthesis has been edited.
150	1st line	This is the first use of flux in this context. Suggest adding or using the word volume The terminology used here is acceptable and commonly used in hydroclimatology.

151	1st Para	I would prefer calling the residual method supply estimates and component method supply estimates rather than residual supplies and component supplies even though my way will get wordy; it is far more precise.
		This is the terminology that is used by water resources experts in the Great Lakes area. While the reviewer is correct on the definition, the Study decided to use the terminology that is more commonly used.
152	Figure 6-1	The second title on this figure should be deleted The graphic has been revised.
153	Last sentence	“declines” sounds like it comes from natural causes, how about “cuts” The Study opted for decline as a more politically acceptable term rather than “cuts”. Some of the cells are blank. This table would look better if the symbols were centered. Replace the 0 with a symbol, maybe a tilde (~). The downward symbols in the key never appear in the table.
155	Table 6-1	The table has been fixed. Somewhere, the low confidence/high variance associated with using such small samples should be discussed. Are the differences indicated statistically significant or within the historical range of normal climate variability. It should be pointed out that such changes are not statistically unusual, if this is the case. The y-axis labels on these plots are unreadable
157	Figure 6-4	In general the graphs were made more legible. The wording has been revised on the graphs. The final report better addresses sampling limitation.
160	2nd Para	The word basis in the sixth line is not the correct word; the statement is unclear. The statement that follows about residual method NBS estimates is out of place and is indicative of the authors’ unfounded bias against the residual method. The point of this analysis is that the MH to Erie fall declines during periods of low NBS and the low supplies of the last decade are unprecedented in the past 60 years. The text has been revised in light of further analysis in the summer to focus on the 1963 to 2006 period. The text now reflects a more neutral perspective.
164		In reference to the last sentence of the fourth full paragraph, if this item is pure coincidence then it is not worth noting in this report. However, it may not be coincidence at all given the discussion in paragraph five. Isn’t a major cause of the decline in fall due to low supplies? The text in the revised chapter in the final report is now consistent with the findings as noted in the new and updated chapter.
164	5th Para.	This discussion is entirely devoted to the types of false conclusions that can be drawn from small samples of autocorrelated time series. It would be better to use the context of extreme low supplies and levels to describe how climate has affected the apparent decline in MH to Erie head difference. This section has been removed in the final report.
165	Figure 6-9	I assume this figure will be formatted for the report. The figure was replaced with more appropriate text and a graphic.
165	1st Para.	“the lakes” can be deleted This has been revised.
171	Table 6-6	Add “of Runoff” to the title. Too many significant figures are provided in the tabulated

values.



The table has been revised to reflect a better estimate of tabulated values.

179 Equation

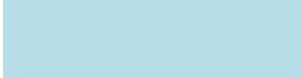
Again in my opinion, this equation, as presented, does not serve to increase understanding of the analyses or results of this study.



The equation has been replaced with a more appropriate graphic that builds the narrative through chapters and culminating with the integration of different components.

183 Figure 7-3

This presentation is very good. Perhaps something similar could be used to replace the equation on page 179.



The graphic has been removed and only the text remains regarding confidence levels.