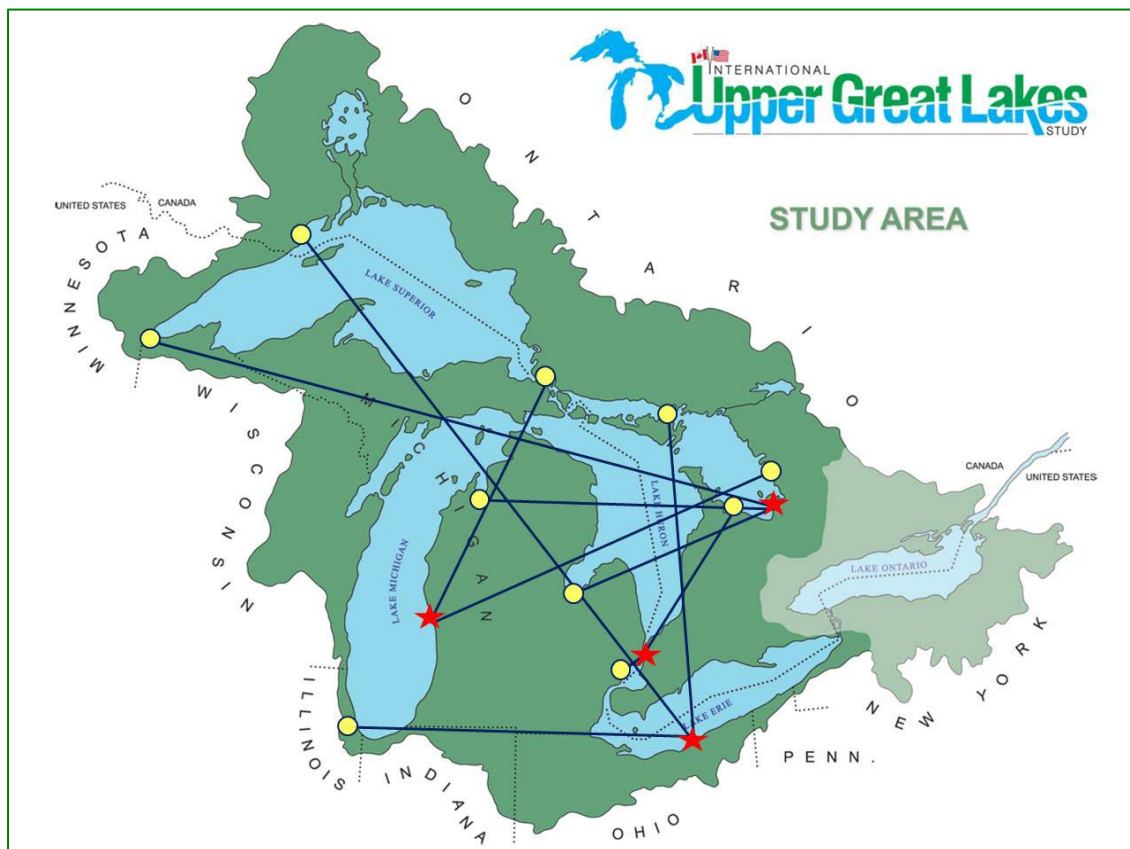




**5th PROGRESS REPORT
to the
INTERNATIONAL JOINT COMMISSION
by the
INTERNATIONAL UPPER GREAT LAKES STUDY BOARD**



Public Meeting Locations accompanying release of the St. Clair River Report

**Semi-annual Appearance
Washington, DC
April 1, 2009**

INTERNATIONAL UPPER GREAT LAKES STUDY BOARD

Commissioners:

The International Upper Great Lakes Study Board submits herein its fifth Semi-annual Progress Report, covering activities from October 1, 2008 to March 15, 2009.

1. SUMMARY

During the reporting period, great progress has been made towards understanding the factors responsible for the estimated conveyance change in the St. Clair River. Given that there are concerns about the many data sources, a comprehensive approach to scientific uncertainty was developed. In addition to the work of the St. Clair Task Team, the Lake Superior Task Team has instructed its Technical Work Groups (TWG) to begin their investigations and data collection and interpretation activities with the view that all must be completed during 2009. The Study Board has begun to think about the decisions that will be required with regard to both phases and are preparing to address the issues and findings that will be presented to the public this summer.

The following are highlights, with more details provided under Section 2:

- Research continued by nearly forty investigators to discover the causes of the declining difference in elevations between Lakes Michigan-Huron and Erie leading to the conclusion that conveyance has changed between 1962 and 2007. However, there is a degree of uncertainty around the results and determining whether the changes are a result of natural or man-made causes.
- One major methodological review was undertaken with the Independent Peer Review (IPR) Group which related to scientific uncertainty. Currently, eight study reports have been forwarded for independent peer review.
- The three proposed International Gauging Stations have now been installed and are collecting and reporting hydrometric data.
- Work has begun on the Draft St. Clair River Report, with some challenges to finalizing the results of various projects. It is still anticipated that the Study will meet the May 1, 2009 target. A strategy for its distribution and accompanying communication framework has been developed which includes 14 public meetings around the lakes. (Locations are shown on the cover of this report).
- Two expert workshops were held, one for the Coastal Zone TWG and one for the Ecosystems TWG to help define the performance indicators that should be considered. The two groups are defining areas of mutual interest.

- Jill Wingfield of the Great Lakes Fisheries Commission has been selected as the Study's public information officer. She is currently actively involved in organizing the upcoming public meetings.

2. STUDY TEAM AND BOARD ACTIVITIES

2.1 LAKE HURON OUTFLOW/ ST. CLAIR RIVER TASK TEAM

The Team has met extensively during the reporting period, through Team and TWG meetings and teleconferences. Each TWG has been asked to develop a summary of findings report consolidating all research conducted and establishing an overall assessment of findings. The following describes their work and preliminary findings.

2.1.1 Hydraulic Modelling and Analyses of Data

Gauge data analysis

The water level - fall relationships between gauge pairs on the St. Clair River were investigated to identify reach conveyance changes over time. Both Drs. Dave Holtschlag and Frank Quinn have separately indicated that changes in water level relationships between gauge pairs have indeed occurred in several reaches along the St. Clair River since the 1962 dredging. They conclude that this implies reach conveyance has changed over time, though changes in river conveyance and estimates of trends or the magnitude of such changes needs to be determined through other analyses.

Bathymetric Analysis

Dr. Dave Bennion has shown that statistically significant changes in bathymetry have occurred between 1971 and 2000, resulting in an increase in conveyance. Though the changes are not constant, but rather variable both temporally and spatially, the bathymetry data indicates that, in general, the river bed tends to be deeper overall now than in 1971. The data also indicate that there have been additional changes between 2000 and 2007, but that these changes are for the most part relatively insignificant (statistically) and if anything indicate a small increase in the bed elevations, implying deposition. These observations provide additional evidence that conveyance in the river has changed. Quantifying the volume of this change requires hydraulic modelling. These results also show that the change is dynamic and not unidirectional.

Hydraulic Model Analysis

By substituting the different bathymetry datasets for each year into three different hydrodynamic models and assuming all other variables affecting conveyance (i.e. channel roughness, shoreline location and elevation, etc.) remained constant, it was estimated that from 1971 to 2000 the conveyance has changed by approximately 9 to 12 cm (+/- 3-7 cm), though these numbers are still tentative. These analyses were performed by Dr. Jason Giovannettone, Jacob Bruxer, Aaron Thompson and Dr. Thierre Faure. This change in water level corresponds to a discharge change of approximately 275 m³/s (+/- approximately 70 m³/s). At this point, even accounting for uncertainty, all

modelling experiments point to an increase in conveyance since 1971. However, modelling also shows that since 2000, the conveyance change has reversed, with the conveyance decreasing slightly. Note that these changes are a result of changes in bathymetry alone, and do not account for other changes that may or may not have occurred over this time period, including changes in channel roughness due to the removal and/or deposition of different bed material, weed growth, shoreline alterations, etc.

The effects of small scale features on river conveyance were also evaluated, including the effects of scour holes around shipwrecks and the bed material forms that may be slowly migrating. A number of cut and fill scenarios were conducted and in general model tests showed that such small scale features, in the upper St. Clair River in particular, have little effect on conveyance. In addition, water surface profiles over the period indicate that the observed changes in conveyance are the result of changes in bathymetry taking place throughout the river, and not in the upper reach of the river as the Baird report claims.

The effect of glacial isostatic adjustment (GIA) on the hydraulics of the river was also investigated. Though the exact amount is uncertain, the St. Clair and Detroit Rivers may be gradually increasing in slope over time due to GIA, which would tend to increase the conveyance in the river. However, any possible change in slope that has occurred since the dredging in 1962 is small, and it was found to have a negligible effect on conveyance over this time period. This conclusion only relates to the impacts of changing river slope on conveyance as evaluated with the hydraulic models, and does not apply to other GIA impacts such as the lake-to-lake relationships over longer periods of time or the apparent lowering of water levels in north-western parts of the basin.

Hydraulic Modelling Analysis Using 'Inverse' Modelling Approach

Dr. Holtschlag also used an inverse modelling approach to investigate conveyance changes over time. The null-hypothesis is that the conveyance in the river has not changed since the 1962 dredging. This was tested by recalibrating the 2007 model estimating the effective channel roughness (in this case Manning's roughness coefficient, "n") in several reaches of the St. Clair River for each year when water level and flow measurements were available (between 1962 and 2006). From this analysis, trends in reach conveyance were again identified, and trends in river conveyance showed a generally increasing trend. With this method, Holtschlag estimated that conveyance increased by approximately six percent. Holtschlag also showed that conveyance has been changing in recent years, i.e., from 2000 to 2007 a range of approximately 200 m³/s was estimated, but the net change has been estimated to be closer to zero. These results support the conclusions reached from the other modelling experiments.

Effects of Ice on St. Clair River Conveyance

Dr. Steve Daly of the Corps Cold Region investigated the effects of ice on the St. Clair River. Preliminary results of this analysis indicate that the 1984 ice jam in the lower St.

Clair River could have caused a long term change of conveyance of the river. This hypothesis is currently being investigated further.

Conveyance Change Analysis using Hydraulic Performance Graphs

Dr. Art Schmidt, of the University of Illinois at Urbana-Champaign, began work to determine if changes in conveyance have occurred in the St. Clair River since the last major dredging in the early 1960s, using estimates of flow for the period 1962-2006. His work has included evaluating the reliability of the historic flow estimates, the equations they are based on, and the measured flows on which the equations were derived. The discharge measurements he had the most confidence in were used with 1-D HEC-RAS models developed by the Hydraulic Modelling TWG investigators to create Hydraulic Performance Graphs (HPG) from which St. Clair and Detroit River flows were determined. These were compared to computed and historically coordinated flows. The HPG generated St. Clair River flows are generally higher than the presently coordinated flows, particularly when water levels on Lake Michigan-Huron are low. The HPG flows consistently better represent the computed flows on the St. Clair River for the latter period (1999-2006). Work is continuing to assess the portion of this change that may be attributable to the use of different technologies, i.e., conventional current meters vs. Acoustic Doppler Current Profilers (ADCP).

The analyses showed that limits and uncertainty in historic flow measurements in the river need to be considered in any comparison of computed flows over the period. The HPG work was limited by the quality of the 1-D models available, particularly on Detroit River, and the lack of measured discharges for large portions of the period (no discharge measurements between 1984 and 1996). Dr. Schmidt noted that differences between the HPG based flows and the coordinated flows are often within the error of the measurements the HPG are based on. He also noted that there was not enough information to determine when a change in channel conditions may have occurred on either river.

Comparison of Stage-Fall-Discharge Curves

David Fay has developed stage-fall-discharge curves for two eras: the 1968-1985 era, during which conventional measurements of stream flow were collected; and the 1996-2007 era, during which ADCP measurements were collected. Preliminary results give further indication that the conveyance has increased since 1962. As in all of the analyses outlined, there is a degree of uncertainty in this statistical analysis.

Estimating Conveyance Change Using Water Level Differences

Dr. Quinn was contracted to study the impact that erosion in the St. Clair River has had on the water levels of Lake Michigan-Huron from 1962-2005. Preliminary results from this study estimate a conveyance change from water level difference comparisons of between 5 and 9 cm, which is within the range of changes computed by hydraulic modelling. Results also indicate that the change may be attributed to an episodic erosion event occurring in the mid- to late-1980s. This analysis is currently under peer review and further analyses are being undertaken to confirm these results.

Conclusions

Hydraulic modelling indicates that at some point, between 1971 and 2000, the conveyance of the St. Clair River has increased. The bathymetry data indicate that the channel has eroded during this time and hydraulic modelling indicates that these changes in the channel geometry have at most been the cause for 12 cm +/- 3 to 7 cm (again, not final) of the head difference between Lake Huron and Lake Erie. This change in water level is the result of changes that have occurred throughout the channel. The cause for the change in conveyance is channel deepening since 1971, indicating erosion has occurred in some reaches of the river. Hydraulic modelling cannot attribute cause to this apparent change in erosion, nor can it identify at what point this change has occurred, whether it be gradual (e.g., ongoing erosion of fine material) or event-based (e.g., due to an ice jam event). Quinn indicates that an erosion event occurring during the mid- to late-1980's may be the cause of the changed conveyance, possibly initiated by scouring caused by the ice jam in 1984, followed by the high flows caused by the high water levels in 1986. Dr. Holtschlag's work does not refute this possibility, but does not show the same monotonic (linear) trends in conveyance change that Dr. Quinn has produced.

2.1.2 St Clair River Sediment Studies

Studies of surficial geology, bed material composition, sediment (suspended and bed load) transport rates both measured and modelled and bed morphology were undertaken to assess whether the St. Clair river bed is stable or eroding and to identify causes. This is based on an initial Baird finding that there has been substantial bed erosion, especially in the upper river between Lake Huron and Black River since 1971.

Several projects were developed to provide necessary characterization of the river with respect to geology, morphology and sediment transport.

Characterization of the river bed and surficial geology

Results from various studies show that the upper river (from Lake Huron to Black River) is underlain by a large glacial sand-gravel deposit resulting from sub-aqueous, proglacial deltaic processes. Beneath this is glacial till (clay deposit with some sand and gravel) with shale bedrock below. In the upper river the sand and gravel deposit is 10 to 15 meters thick and this thins rapidly downriver and disappears in the vicinity of the Black River. Thinning of the gravel deposit is accompanied by increasing thickness of the till layer. The bedrock remains at approximately the same elevation throughout, is 10 to 20m below the river bed and is not a limiting factor in river bed erosion.

Bed morphology

Information has been derived on bed morphology from high resolution multi-beam acoustic surveys focused on the lake bed where it funnels into the river and the river bed downstream to Black River. The purpose of these surveys was to provide characteristics of the river bed and bathymetric information for flow and sediment transport modelling. The surveys also provide information on bed forms and, therefore, a qualitative assessment of sediment transport in the river.

Flow and shear stress measurement and modelling

Direct measurement of the 3-Dimensional (horizontal, vertical and longitudinal) flow structure in the upper river was done using ADCP along several cross-sections spaced less than one channel-width apart. These measurements were used to identify the flow transition from a lake environment to a river. Following the transition through the Blue Water Bridge, there is a recirculation zone along the Canadian shore near the casino in Sarnia, Ontario. Bed shear stress mapping from these data show a maximum value of less than 15 Pascals in the narrowest sections around the Bluewater Bridge and values generally less than 10 Pascals elsewhere downstream to Black River. This an insufficient shear stress to transport the mostly gravel and cobble substrate in that section of the river. 2-Dimensional flow hydrodynamics was also modelled using HydroSed2D which was then applied to sediment transport and morphodynamic calculations with the same model. Shear stress values and spatial pattern agree very closely with those calculated from the ADCP data. Along most of the river downstream of Black River bottom shear stresses in the center of the channel (the maximum value in most cross-sections) is 2-3 Pascals which is insufficient to transport even fine sand and is almost an order of magnitude lower than the shear stresses found in active sand-bed rivers. In most areas of the river bed, shear stresses are insufficient to mobilize the bed material.

Sediment transport calculations and modelling

HydroSed2D (chosen primarily because it includes a routine for gravel bed rivers and adjustments of particle size on gravel beds to imposed flows and particle transport) was run using the new bed material and shear stress estimates for the upper river. It showed that bed shear stress, in all areas, is insufficient to move the average particle size on the river bed. In many areas shear stresses are 2 to 3 times less than those required to move the material, even at high discharges representing the upper range of flows in the flow duration curve for the river. Inspection of the videos indicate that in many locations in the upper portion of the river, the bed has experienced armouring with small amounts of sand moving as bedload over the armour layer, small dune-like features and exposed till areas.

Conclusions

Evidence to date suggests that in the upper reach most of the bed is immobile, bed material transport is negligible and there has not been any significant net bed erosion occurring. However, because of limited bed material data in the lower reach it is not yet clear if the river bed could be eroding as sediment transport may be more active due a finer bed materials in this reach. This issue needs to be studied in more detail with the help of a hydraulic performance graph that includes morphological changes.

2.1.3 Hydroclimatology Technical Work Group

Investigations focused on comparative hydrological data analysis, statistical and hydroclimatic modelling of contemporary water supplies, and investigation of new observation and monitoring technologies of over-lake precipitation, watershed runoff and lake evaporation. Modelling studies were also undertaken to quantify and

separately identify the impact of climate on lake levels from that of changes in channel conveyance.

Comparative Hydrological Data Analysis

A comparative analysis of pertinent Great Lakes hydrologic data was undertaken by Dr. Frank Quinn. Because water supplies to the Great Lakes can be computed by two independent methods (component and residual), the analysis provided the opportunity to identify differences between them that could provide insight to both climate and channel conveyance changes. Ideally, the two data sets should arrive at the same estimate of net basin supply (NBS). Dr. Quinn investigated the uncertainty inherent in the data and made recommendations on improvements to the computational procedures. To assist hydroclimatic investigations, the Data Verification and Reconciliation TWG is revising the residual NBS series.

The 10-year estimates of water balance components from 1948 to present indicate that for the last 10-year period, there has been a rare decrease in the Lake Michigan-Huron net total supply (NTS) (residual Lake Michigan-Huron NBS plus the St. Marys River inflow), with a decrease of about fourteen percent based on the 40-year mean. Similarly, there has been about a ten percent decrease in outflow from Lake Michigan-Huron during that same period. This resulted in a large negative water balance for the lake over that period, with an average change in storage of about 245 m³/s per month. This, coupled with the previous 10-year negative flow balance of 130 m³/s per month has resulted in the persistent low levels of the lake. Although there is some question on the reliability of residual NBS due to the uncertainty in St. Clair River outflows, there is clearly a strong climate signal in the decrease of supplies given the fact that 10-year average St. Marys River inflows have proven quite reliable.

Statistical Modelling and Analysis

Trend and Change point Analysis. Extensive statistical analyses of the hydroclimatic data were undertaken by Dr. Taha Ouarda and his associates to identify climate trends, change points and other statistical anomalies to discern their relationship to the change in lake level relationship between Lakes Michigan-Huron and Lake Erie. Statistical analysis was applied to each lake's monthly and annual water supplies and lake levels, water supply components (over-lake precipitation, basin runoff, and lake evaporation), Connecting Channel flows, air and water temperature, change in storage and the change in fall between Lakes Michigan-Huron and Lakes Erie. The period of record evaluated was 1948-2005 for most data, but when available, a longer record was used, primarily for lake levels and channel flows. Because of problems identified in the comparative hydrological data analysis, only component NBS were used.

While no long-term monotonic (linear) trends were discerned in NBS to Lake Superior, Lake Michigan-Huron and Erie exhibited a weak increasing trend over the period of record. This was supported by increasing trends found in watershed runoff and over-lake precipitation, while lake evaporation (and similarly, air temperature) showed no long-term trend. However, change point analysis (discontinuities in the record) revealed

more pronounced trends (increasing and decreasing) throughout the record on shorter (decadal) timescales. Lake Superior again distinguished itself from its lower lakes by having a rising trend in water supplies from 1948 to 1966, and declining supplies thereafter. No change point was detected for Lake Michigan-Huron NBS, only a slight rising trend. Lake Erie behaved counter to Lake Superior, with a rising trend from 1948 to 1981, followed by a slight declining trend through 2005.

A statistical analysis of the change in fall between Lakes Michigan-Huron and Lake Erie (1860-2005) was also conducted. Change points were found in 1888, 1923, and 1988. After each breakpoint, downward shifts with downward trends were exhibited.

Stochastic Frequency Analysis. Another statistical analysis was performed by David Fay and Yin Fan on the change in lake level relationships using the nearly 50,000 years of stochastically generated levels from the International Lake Ontario-St. Lawrence River Study. The simulated lake levels in this model assume no change in the conveyance capacity of the St. Clair River. They calculated the frequency of occurrence of the change in fall between Lake Huron and Erie (over successive 20-year time segments) in the stochastically generated data set and then compared the distribution to the observed average change in fall for 1969-1988 and 1989-2008. These results imply that it is unlikely that changes to NBS can explain all of the observed change in fall (i.e., conveyance change, GIA, and/or other factors were almost certainly also involved).

Hydroclimate Modelling and Analysis

In an effort to improve component net basin supply estimates, an assessment of current estimates of the water balance, their uncertainty and methodological approaches has been undertaken with preliminary results now complete. This includes studies focused on comparison of over lake precipitation (P), studies assessing runoff into the lakes (R), and observations and modelling estimates of lake evaporation (E). The specific terms (P, R, E) are being derived in part from existing and operational numerical weather and climate models that use data assimilation techniques to derive the components of the water balance. A series of independent models that complement the existing quasi-operational modelling system developed by GLERL are being used to assess shortcomings in existing modelling approaches and further refine the water balance estimates.

Initial investigations indicate those current GLERL model estimates of the component NBS show no systematic bias, however there can be large differences between the methods being developed and the GLERL techniques. The techniques being developed are providing insights into the error structure and confidence limits that can be expected from the component estimates of NBS.

New Observation and Monitoring Technologies

Lake Evaporation. A field study is currently being carried out by Drs. Chris Spence and Peter Blanken that directly measures evaporation over Lake Superior using an

eddy co-variance system. Meteorological data collection began on June 1st, 2008 at Stannard Rock lighthouse, 24 miles southeast of Manitou Island. Observed data suggest that the atmosphere above the lake in June and July is highly stable, with most energy directed to heating the water. The winter data are currently being analyzed. These data were very useful in correcting the evaporation algorithm.

Overlake Precipitation. Dr. Carlo DeMarchi has estimated the error in estimates of over-lake precipitation and runoff for each lake. He has also assessed the uncertainty in Great Lakes Environmental Research Laboratory (GLERL) methodology for lake-wide river runoff estimates. It was shown that inter-basin error is potentially the largest source of uncertainty within the GLERL model. Same-basin error is relatively low for the Lake Erie and Michigan basins, where hydrometric gauge density is highest.

Runoff Estimation. Dr. Taha Ouarda is proposing to develop a new technique for estimating streamflows at ungauged sites based on regional flow duration curves (FDCs) and nonlinear spatial interpolation techniques. A comprehensive evaluation of existing approaches of regional FDC estimation and a comparison of a spatial interpolation method with drainage area ratio methods will be performed. This study will lead to the development of a real-time streamflow estimation tool for ungauged basins within the Great Lakes basin.

Impact of Climate on Lake Levels

Two studies were undertaken to quantify and separate the impact of climate on lake levels from that of changes in channel conveyance. The first by Debbie Lee is a modelling analysis that quantifies the contribution of each hydrologic factor (channel conveyance, NBS, ice and weed retardation, and Lake Superior outflows) on lake level. Due to the uncertainty in water supplies, the analysis was conducted for both residual and component NBS. Due to the uncertainty of the causative factor in the change in St. Clair River conveyance, four time periods were considered: 1) 1962-2006 (the period since the last major navigation channel deepening as the basis for comparison), 2) 1971-2006 (the period since the last bathymetric survey), 3) 1984-2006 (the period since the record St. Clair River ice jam), and 4) 1989-2006 (the period when gauge and statistical studies point to conveyance changes).

The second study by Dr. Brian Tolson, is looking at the distribution of change in fall using bootstrap statistical techniques given two alternative climates (defined as 1948-1972 and 1972-2007), as identified by Dr. Ouarda. He also considered two hydraulic regimes for the St. Clair River channel conveyance (1962-1977 and 1988-2006). He found that the distributions of fall were significantly different for the two climate periods, while the distributions of fall for the two conveyance changes were less so, indicating climate is the dominant force in the change in lake levels.

Conclusions

In conclusion, the studies indicate that while channel conveyance and glacial isostatic adjustment have affected the fall between Lakes Michigan-Huron and Lake Erie, climate has likely played a significant role. Because lake levels integrate all three factors

(precipitation, evaporation and runoff), it is difficult to separate and quantify their individual effects. The hydroclimatic studies have revealed the need for more careful estimates and continual monitoring and analysis of Great Lakes water supplies and connecting channel flows. New procedures and techniques for doing so are under development and evaluation.

2.2 LAKE SUPERIOR REGULATION TASK TEAM

The Team held two meetings during the reporting period, to guide TWG progress and emphasize the need to concentrate efforts in 2009 on data collection and analysis, developing performance indicators and the interpretation of these indicators into mathematical relationships that can be incorporated into a shared vision model to evaluate alternative outflow regulation plans. All TWG have begun work on their contextual narratives which describe baseline conditions, key trends in their area of interest, how their interest adapts to changing water levels, and how an interest is affected by a regulation plan.

The Team has established a Plan Formulation Group (PFG). This group held its first workshop in October 2008 in Cornwall, Ontario and is working to develop alternative Lake Superior outflow regulation plans. It is composed of scientists and engineers from Environment Canada, the U.S. Army Corps of Engineers and Stanford University with experience in designing, testing and implementing such outflow regulation plans. The group is working closely with the Plan Evaluation Group (PEG) and the other TWGs to develop draft objectives and evaluation metrics to use in designing alternatives.

The following eight initial regulation plan alternatives are being developed. While these plans are to be multi-objective plans, they are intended to place more emphasis on a different primary goal to illustrate inherent trade-offs.

1. Constrain the range of extreme (high and low) levels on Lakes Superior and Michigan-Huron. (**Reduced Extremes Plan**).
2. Maintain the long-term average of Lake Superior even in a drier climate, but allow some inter-annual variation needed for the environment. This was initially labeled Superior for Superior. (**Modified Superior-for-Superior Plan**).
3. Improve the flow regime in the St. Marys River. This would consider fisheries needs in the St. Marys Rapids, reduced spillage (or variation from month-to-month) through the rapids (i.e., dependable flow for hydropower), and dependable river levels for navigation. (**St. Marys Flow Plan**).
4. A plan that is based on pre-project outflows and attempts to mimic natural outflow, while considering impacts to other interests and the capacities of the control structures. The pre-project outlet case, without alterations, will also be used for comparison (**Natural Flow Plan**).
5. A plan that attempts to constrain the range of Lake Michigan-Huron but still respects the conditions on Lake Superior, i.e., not as biased as the fencepost MH plan considered in earlier plan formulation (**Modified MH Plan**).

6. A simplified Superior-Michigan-Huron lake level balancing plan, i.e., the same goal as Plan 1977A but using a simplified approach if possible (**New Balancing Plan**).
7. **Measure 1.21 from the Levels Reference Study – modifications to Plan 1977-A** (including changes to outflow forecasts), increased maximum winter outflow limit, use of a new balancing equation that modifies balancing parameters for Lake Superior, and no Criterion (C) to limit flows.
8. **1955 Modified Rule of 1949** – This was the active regulation plan from 1955-1973 and was the basis of comparison in the IJC's 1979 order.

The natural flow plan as well as plans #7 and #8 have been completed and are ready for evaluation. Work has begun on the other plans and initial versions are scheduled to be completed in April.

PFG is currently working with the PEG to develop a Plan Formulation and Evaluation Strategy for the Study in anticipation of a formal peer review scheduled for April 20th in Burlington, Ontario.

The following sections describe activities of the Team's TWGs.

2.2.1 Coastal Processes TWG

The Coastal Zone TWG held an experts workshop in October 2008 to discuss potential performance indicators and assessment methodologies. The information was used to refine the initial scoping documents and prepare a draft of an overall strategy document. The TWG has been working on the strategy over the past few months and expects to complete the document over the coming months in preparation for peer review anticipated in June 2009. The TWG is considering the broad themes of flooding, low water, erosion, and shore protection as they relate to water level regulation.

In addition to the development of the overall strategy, a contract was initiated to review available models for erosion of cohesive and sandy shorelines. The information is expected to help determine the available options and the associated uncertainty in addressing erosion in the Study. A final report was also received on a contract undertaking a literature review and assessment of potential methodologies that could be utilized to measure the economic impacts of low water conditions on coastal property owners. A scope of work looking at availability of GIS data in select shoreline areas of the upper Great Lakes was refined in coordination with the Ecosystems TWG and the contracting process initiated. The information will be useful to both TWGs in the process of selecting Study sites. Work also continued on refining the initial draft of the contextual narrative.

2.2.2 Commercial Navigation TWG

The Commercial Navigation TWG met with staff of Buffalo District of the Corps of Engineers to conduct economic modelling of the impacts of alternative lake level

scenarios on navigation activities. The existing Great Lakes Systems Analysis of Navigation Depths (GLSAND) model developed by that office will be the principal tool used in the evaluation.

The TWG has commenced the preparation of interest satisfaction curves for use in the development of water level regulation alternatives. A contract for preparation of the contextual narrative has been issued, and the project is underway. The draft report is to be delivered by the end of March, and the final report is to be completed in June 2009.

2.2.3 Ecosystems TWG

In mid-December 2008, a team of renowned Great Lakes scientists led by Dr. Jan Ciborowski (University of Windsor) and Dr. Gerald Niemi (University of Minnesota-Duluth) released a White Paper for the Study identifying potential ecological impacts of lake level changes, proposed study areas, performance indicators and an overall strategy needed to evaluate these potential impacts in the upper Great Lakes. Revisions to the paper are underway, with a final edition expected later in March 2009. The White Paper formed the centerpiece for discussions at the TWG Experts Workshop held on February 3rd and 4th in Windsor, Ontario. Attended by almost 40 experts in a variety of fields, the Workshop provided the TWG with valuable feedback on modelling, performance indicators, study areas, and study strategy.

In early February 2009, the literature review led by Dr. Val Brady (University of Minnesota-Duluth) produced an initial draft list of source material. Further research is underway, and an internal review by peers is planned for early March 2009 in order to capture additional source materials. The completed review will identify the most relevant and best-conducted studies relating to water level fluctuations in the upper lakes and associated ecological impacts. In addition, the Ecosystems and Coastal Zone TWG have combined resources to hire a separate contractor to develop a data inventory and summary report on available spatial data in specified study areas.

In early March 2009, a contract was finalized with Central Michigan University for Dr. Don Uzarski to prepare the contextual narrative, which among other things, will present a fact-based overview of baseline conditions and trends in the upper lakes; a commentary on societal perspectives; a qualitative assessment of issues related to ecosystem components and changing water levels; and an overview of climate change impacts and possible adaptive management measures. Dr. Uzarski has formed a small writing team and has initiated work to deliver the report before the end of March 2009.

The TWG is working to undertake critical data/information gathering in the 2009-10 field season. It is tentatively planning to host a workshop in early April 2009 to plan its modeling approach, and it is pursuing a number of contracts to hire outside expertise and assistance needed to accomplish its tasks under tight timelines.

2.2.4 Recreational Boating TWG

The Recreational Boating TWG has developed a partnership with the Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) to share the funding of 2 interns as Research Analysts and Field Researchers. One U.S. Research Analyst will be hired this spring. The Canadian interns began work in November 2008 and have catalogued 180 reports pertaining to water levels. They have also begun the task of identifying locations, contact information and the number of slips in marinas located in the Study's survey areas. Marinas within seventeen 80 km diameter areas (ten in Canada and seven in the U.S.) will be surveyed. Over 100 marinas on the Canadian side have been identified so far that will be physically surveyed for water level impacts by the interns. At its TWG meeting in February in Detroit, the questionnaire that will be used by the interns was reviewed and refined. The TWG has also begun work on its contextual narrative.

2.2.5 Municipal, Industrial and Domestic Water Uses TWG

The contract to inventory municipal and industrial water intakes and wastewater outfalls was completed in October 2008. Though the contract was completed, the inventory is incomplete due to lack of, as well as inconsistent, information about some facilities in different states and the Province of Ontario. The primary deficiency was the lack of information on intake elevations. For example, where intakes did have an elevation or depth, it was uncertain what datum was used as its reference. The next phase of the study will be to contract services to obtain detailed information on municipal and industrial water intakes, i.e., intake elevation, critical water intake system elevation, and other information needed for the performance indicators. Not all intakes will be surveyed. The contract will focus on the more vulnerable areas, i.e., shallower areas of the Great Lakes.

A contract regarding future water demand was initiated with Dr. Ben Dziegielewski and a draft final report has been received. Efforts of the TWG over the last six months have been devoted to initiating this contract and reviewing the different work products. A no-cost extension to the contract will be granted so that 2005 water use data can be obtained for all the states and also to allow Dr. Dziegielewski an opportunity to present his findings to the Study Board at a future meeting.

A revised draft of the contextual narrative was reviewed by the TWG and will be submitted to the Task Team co-leads later in March.

2.2.6 Hydropower TWG

Dr. David Patton of Potomac Economics, an independent market monitor for the Midwest Independent System Operator, has been retained to prepare a contextual narrative for hydropower. A draft of this narrative is due to be completed by the end of March, but will continue to be updated over the remainder of the Study.

Significant thrusts now underway in Ontario, Michigan, the United States, Canada and elsewhere to increase the capacity and supplies of cleaner and renewable sources of electricity, and carbon pricing, are expected to play an important role in helping to understand the future value of hydropower, and potential responses of this sector to changes in supply-mix portfolios, market demand for clean sources of generation and prices. This analysis will complement a more detailed study of hydropower prices, which is to be carried out through 2009.

The TWG has drafted objectives and performance indicators to guide plan formulation and evaluation, and will continue to refine these throughout the year. Broadly, the objectives include maximizing hydropower production, ensuring predictable flows and effectively managing ice conditions. Power capacity, power generation, the value of generation, month-to-month variations in flows, and stable ice formation are among the potential performance indicators.

The TWG also discussed the hydropower component of the “prototype” shared vision model (SVM) with the PEG and will continue to work with PEG on refining it in Year 3. The International Lake Superior Board of Control recently approved a more accurate model for measuring flows into the United States Army Corps of Engineers’ power plant, which will be incorporated into the SVM.

A joint meeting of the Hydropower, Commercial Navigation, Ecosystem TWGs is being planned for some time this summer in Sault Ste Marie.

2.3 SYNTHESIS GROUPS

2.3.1 Plan Evaluation Group

The Plan Evaluation Group (PEG) co-leads continue to work with the Lake Superior Task Team TWGs to develop their performance indicators and algorithms. PEG co-leads attended most TWG meetings and prepared presentation material for expert workshops, including a Study overview, participated on TWG conference calls, provided guidance on PI development and developed a presentation for the TWGs to use at their meetings. All TWGs have a list of preliminary performance indicators and most have selected potential Study site locations. The PEG has contracted Dr. Steven Renzetti of Brock University and is in the process of hiring a U.S. economic advisor to help provide support in the development of performance indicators and provide expert feedback and guidance on the plan evaluation process.

PEG co-leads worked with the TWGs to ensure that their contextual narratives were underway, and prepared the scopes of work and managed two contractors who are required to work with the TWGs on their contextual narratives and develop an overview contextual narrative for the Great Lakes basin. Template documents were provided to all TWGs and the PEG co-leads responded to TWG requests, reviewed contract proposals and provided guidance. All TWGs are expected to have first drafts of their contextual narratives by spring 2009.

The PEG continues to work with PIAG in holding a series of “Circles of Influence” workshops in which some background on the Study is provided and participants are then asked to describe problems and opportunities from their point of view. In addition to the first workshop held in Muskegon, Michigan on May 3, 2008 which concentrated on coastal interests, PEG has held three circles of influence workshops during the reporting period:

- Ann Arbor Michigan – Oct. 16, 2008 (Environmental interests)
- Harrison Township, Michigan – Oct 16, 2008 (Lake St. Clair interests)
- Toronto, Ontario – Nov 20, 2008 (First Nations)

Workshop summaries have been shared with workshop participants and the Study Team and are available through the SharePoint server. Another round of workshops is expected throughout 2009.

The PEG has continued to work on a prototype evaluation model and preliminary evaluations using the ‘fencepost’ plans, developed early in the Study, have been made available to all the TWGs for their use and assessment.

In response to direction from the Study Board, PEG prepared an adaptive management discussion document which has evolved into an Adaptive Management Work Plan presently being reviewed by the Board. The Board has decided that an Adaptive Management sub-group would be established, with oversight provided by PEG. Plans are also underway to conduct an initial experts workshop.

As part of the decision process, PEG conducted two practice decision workshops with the Board at their December and February Board meetings. In support of this, PEG has developed an initial draft of the Study Mandate, Goals and Decision Guidelines to assist the Board with its decision-making. They have also developed with the Board, a Decision Framework for the St. Clair portion of the Study.

2.3.2 Uncertainty Analysis Approach

An independent peer review (IPR) of the Study’s proposed uncertainty analysis strategies related to the St. Clair River conveyance factors was made on December 4th in Burlington, Ontario. In order to address issues raised by the IPR group during that review, two meetings were held by the Study Team and invited experts having a specialization in uncertainty. The meetings were held in Burlington, Ontario on January 6th and 7th and in Dulles, Virginia on January 14th and 15th. A strategy proposed at those meetings by Dr. Brian Tolson of the University of Waterloo is being applied and forms the basis for evaluation. In addition, nearly 70 tasks were identified leading to a more refined approach for considering the uncertainty surrounding the determination of the apparent declining differences between Lakes Michigan-Huron and Erie. A report on these tasks is being compiled and will be provided to the group.

2.3.3 Consideration of Potential Remediation and Mitigation Options

A summary of structural and non-structural measures that have been suggested from past studies of the St. Clair River was compiled by W.F. Baird, Ltd. at the request and approval of the Study Board. The report also included measures that could be undertaken that were not previously studied, like inflatable weirs and in-stream power turbines. A separate report on institutional frameworks toward implementation of any of these measures is also being completed by Mr. Ralph Pentland, a well respected engineering professional with extensive experience in this area.. The information from both of these investigations will be included in the St. Clair River Report.

2.4 PUBLIC INTEREST ADVISORY GROUP (PIAG)

During the reporting period, the Public Interest Advisory Group (PIAG) met for a full day in Windsor on December 12th and members received detailed briefings on the status of the St. Clair River and Lake Superior regulation parts of the Study. PIAG also met once via teleconference on February 26th in which it was briefed on the status of the draft St. Clair River Report and its views were solicited on a strategy for the consultation process following release of the report.

During the period PIAG members continued to be engaged in the activities of the TWGs and on a rotating basis, participated in Task Team meetings. PIAG also hosted a public meeting in Toledo, Ohio on November 19th bringing the number of public meetings in 2008 to fifteen. Circles of Influence workshops were held on October 16th in Harrison Township on Lake St. Clair and Ann Arbor, Michigan that included participation by a wide range of environmental organizations, riparians and local government representatives. In addition, a Circles of Influence workshop was held with First Nations/Native American representatives in Toronto on November 20th at which participants discussed impacts of water level changes, the role of traditional knowledge and the engagement of native people in the Study.

Media reports during the period largely focused on increasing water levels, compared to last year. A press release was issued announcing the new schedule for release of the draft St. Clair River Report. The third issue of the "On the Level" newsletter was completed and work continued on development of fact sheets regarding the various aspects of the Study. A detailed plan for release of the draft St. Clair River report and for the following public consultation process, including a series of 14 public meetings to be held in May and June 2009 has been developed. The locations of these hub and satellite public meetings are displayed on the cover of this report. Planning is also underway to host Peter Annin and colleagues from the Institute for Journalism and Natural Resources on May 2nd in the Detroit area for briefings on the draft report.

Jill Wingfield, formerly of the Great Lakes Fishery Commission was hired as Public Information Officer for the Study. Ms. Wingfield is already working closely with PIAG to develop a customized outreach plan for all members, including participation in the public meetings.

2.5 STUDY MANAGEMENT

2.5.1 Meetings

The various groups associated with the Study have met throughout the last reporting period. Appendix 1 shows the groups, activities, dates and locations of these meetings. Meetings planned for April through June are shown in Appendix 2.

2.5.2 Budget/ Expenditures

Tables 1 & 2 below show approved, committed and spent amounts in the U.S. and Canada through March 15, 2009. For the US, funds reflect amounts provided in FY08, carried into FY09. US Funds for FY09 have been requested and are pending.

Table 1 - U.S. Funding (in \$1000US)

Activity	Budget ¹	Committed ²	Spent ³	Difference ⁴
Study Board and Management	423	16	400	7
St. Clair Task Team & Hydroclimatology TWG	772	0	767	5
Lake Superior Regulation Task Team	368	0	367	1
Public Interest Advisory Group	140	0	140	0
Information Technology	0	0	0	0
Plan Evaluation Group	251	16	233	2
Peer Review Group ⁵	6	0	6	0
Grand Total Budget	1960	32	1913	15

Notes:

1. Study Board budget
2. Funds allocated for Principal Investigator or Agency to be spent in this calendar year.
3. Funds spent to date
4. Difference between the budget and committed plus spent which will be carried into next Fiscal Year.
5. Funds shown were those provided through the Institute for Water Resources for travel. Additional funds were provided by the IJC and are not shown.

Table 2 - Canadian Funding (in \$1000Cdn)

Activity	Budget ¹	Committed ²	Spent ³	Difference ⁴
Study Board and Management	389.5	5	358	26.5
St. Clair Task Team & Hydroclimatology TWG	1180.5	189.5	563	428
Lake Superior Regulation Task Team	516	306.5	176.5	33
Public Interest Advisory Group	50	0	30	20
Information Technology	75	106	23	(54)
Plan Evaluation Group	110	47	29.5	33.5
Peer Review Group ⁵	30	23	43	(36)
Grand Total Budget	2351	677	1223	451

Notes:

1. Study Board budget
2. Funds allocated for Principal Investigator or Agency, to be spent by March 31, 2009
3. Funds spent to date
4. Difference between the budget and committed plus spent. Surplus to be reallocated to next Fiscal Year.
5. Funds for independent peer review administered by the IJC

2.5.3 Independent Peer Review

As mentioned in Section 2.3.2, the Study Team met with the IPR Group once during the reporting period to address scientific uncertainty. Eight Study reports are in the process of being sent out for review. The key chapters in the St. Clair River will be sent in out April 2009 for review.

3. IJC ADVICE, CONSULTATION AND INFORMATION

The Study Board would like clarification/updates from the Commission on the following topics and issues:

- Commissioners views on preliminary results on the St. Clair River. The implications of these findings in light of the significant amount of scientific uncertainty.

- Criteria for determining whether remediation is warranted. If the cause of the change is not directly attributable to a particular human activity, is remediation warranted?
- Report release schedule. Some scientists are still completing analyses, but we are still targeting a May 1, 2009 release of the draft report.
- Public meetings strategy. Are there any questions regarding the strategy? The plan is to have only Study Board, PIAG and scientists participate in the meetings. Does the Commission agree with this approach?
- Due to a number of reasons the allocated Canadian budget was not fully spent this Fiscal Year. The Study will be requesting that these substantial funds be reallocated to the 2009-10 Fiscal Year and will be advising the Canadian Government accordingly.

Respectfully submitted,



GENE STAKHIV
U.S. Co-Director



TED YUZYK
Canadian Co-Director



KAY FELT



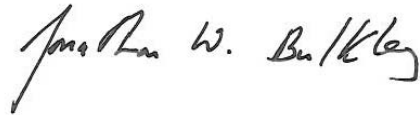
JIM BRUCE



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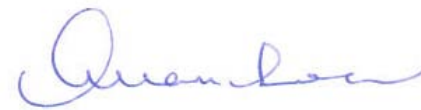
JONATHAN BULKLEY



JON GEE



JOHN BOLAND



ALLAN CHOW



TONY EBERHARDT
U.S. Study Manager



SYED MOÏN
Canadian Study Manager

Appendix 1 – Meetings Held Related to the Study

	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09	Mar 09
Study Board			Windsor (10-11)		Windsor (24-25)	Washington, DC – (30)
Task Teams		SCTT Windsor (24-25)	LSTT – Burlington (2-3)		SCTT Windsor (3-4) LSRTT – Burlington (9-10)	SCTT Synthesis Mtg. – Burlington (18-19)
TWGs	Plan Eval. Group – Cornwall (6-7) Coastal Expert Wksp.- Port Huron (14-15) Hydro-climatic Group – Burlington (15-16) Hydraulic Modelling TWG – Detroit, MI (21-22)	Sediment Studies TWG – Urbana, IL (10-11)	Plan Formulation Group – Burlington (4)	Hydroclimatic Group Chicago (22)	Ecosystem Experts Workshop Windsor (3-4) Rec. Boating Mtg. – Detroit (18-19)	
PIAG			Windsor (12)			
Public Mtgs.						
Other	IJC Appearance – Ottawa (29)		Uncertainty Review IPR Group – Burlington (4)	Uncertainty Workshops Burlington (6-7); Dulles, VA (14-15)		

Appendix 2 – Planned Meetings Related to the Study

	Apr 09	May 09	Jun 09
Study Board			
Task Teams			
TWGs	Plan Formulation Group – Burlington (21-22)		
PIAG	Detroit (7)		
Public Mtgs.		Sarnia (19) (Detroit/ St. Clair/ Owen Sound) Cleveland (20) (Manitoulin Is./ Chicago/ Thunder Bay)	Muskegon (9) (Parry Sound/ Sault Ste Marie) Midland (11) (Travers City/ Duluth/ Superior/ Bay City)
Other	IJC Appearance Washington, DC (1) IPR Group – Windsor (8)		IPR Group Meetings (TBD)