



**Tenth Semi-annual Progress Report  
of the  
International Upper Great Lakes Study  
to the  
International Joint Commission**



**Study Public Meeting in Kagawong, Manitoulin Island on Saturday, August 6, 2011  
(Photo credit: Syed Moin)**

**covering activities from**

**April 1 through September 30, 2011  
INTERNATIONAL UPPER GREAT LAKES STUDY BOARD**

Commissioners:

The International Upper Great Lakes Study Board submits herein its tenth and final Semi-annual Progress Report, covering activities from April 1 through September 30, 2011.

## 1. SUMMARY

During this period, the emphasis has been on completing the key aspects of the Study, namely evaluating candidate regulation plans; conducting 'exploratory' multi-lake regulation analyses, completion of an 'exploratory' lake level restoration report; finalization of an adaptive management strategy and conducting public meetings and gathering public comments on these aspects.

The following are highlights of activities over the last six months, with more details provided under Section 2:

- The TWGs have completed their work and given their "stamps of approval" on performance indicators (PI). They have also provided final coping zones. The PI and coping zones have been incorporated into the Shared Vision Model (SVM) which was used to evaluate alternatives.
- A version of the SVM was placed on the Internet to allow all Study participants to make pair-wise comparisons of plan alternatives.
- At its September meeting, the Study Board **tentatively** chose an alternative, referred to as Nat64D, to replace Plan 1977-A. The plan is a simpler version of the current plan 77-A, and is a marginal improvement over the existing plan, slightly lowering the highs and raising the lows that occurred historically. The plan meets all of the criteria established by the Study Board, including improved performance over 77-A during extreme climate scenarios. Nat64 is currently being independently evaluated in an attempt to further optimize its performance under a wide range of conditions. The new plan will be discussed and approved by the Board before the semi-annual IJC Appearances in Oct, 2011.
- A synthesis report has been completed which considers all hydroclimatic scenarios investigated for the Study. It defines those scenarios that are best used to determine the robustness of plan alternatives.
- The independent peer review of four of the nine products provided to the Independent Peer Review Group has been completed. The Study is completing its responses to the remaining five reviews.
- The Plan Formulation and Evaluation Team has received 'Stamps of Approval' from each of the six TWGs, certifying that the analytical components of the Shared Vision Model

(SVM) accurately represented the outputs of the individual models and performance indicators developed through each TWG.

- The Study Board has started drafting the final report. Three Chapters have been drafted to date. The IPR will be reviewing 4 of the 10 chapters with their external reviewers, with all 10 chapters being reviewed by the IPR co-leads.
- Thirteen public meetings addressing Study progress, including the exploratory lake level restoration report, were held around the Great Lakes between July 18<sup>th</sup> and August 11<sup>th</sup>. Information about the Study and meetings was provided in a brochure entitled: “Addressing Future Water Levels on the Upper Great Lakes: Toward a New Regulation Plan” which appeared in several regional newspapers. Nearly 1200 people attended the meetings. PIAG met in August and is in the process of drafting their chapter for the Study’s final report, and will present some of their material at the fall IJC appearance.
- An Adaptive Management Strategy has been endorsed by the Study Board that recommends on-going monitoring of hydroclimatic conditions by a Great Lakes water management board that would continue after the IUGLS is completed. Future consideration of multi-lake regulation is part of the strategy as an alternative for addressing uncertain hydrological futures.
- Metadata (i.e., summaries for each study that follow an information management template) for all Phase 1 investigations have been compiled and is underway for the Phase 2 work. The Study data and reports will be archived on the IJC server.
- Mr. Ted Yuzyk and Dr. Syed Moin returned to their positions as Canadian Co-Director and Co-Manager. Ms. Wendy Leger returned to her role as Canadian Co-Lead of the Adaptive Management TWG.
- Dr. Patricia Madigan and Ms. Mary Morgan were selected as new US members of PIAG, replacing Dr. Kate Bartter and Mr. Jeff Vito, respectively.

## **2. STUDY TEAM AND BOARD ACTIVITIES**

### **2.1 LAKE SUPERIOR REGULATION TASK TEAM**

During the reporting period, all technical work groups have completed their work in developing PIs and coping zones, although refinements continue. The Plan Formulation and Evaluation and Adaptive Management TWGs have worked closely to incorporate the PIs into the latest version of the SVM and to determine how the resulting alternatives may be modified to address uncertain hydrological futures.

The Plan Formulation and Evaluation TWG conducted two evaluation exercises with the Study Board, which enabled the Study Board to tentatively select a new regulation plan.

### **2.1.1 Performance Indicator TWGs**

#### **Coastal Zone TWG**

The Coastal Zone TWG has continued work related to the sensitivity of flooding, low water, erosion, and shore protection impacts expected from alternative Lake Superior regulation plans. Coldwater Consulting Ltd. has completed their work for the development of a modelling tool that considers water level impacts on shore protection infrastructure along the Lake Superior and Lake Michigan-Huron shoreline. The Structures Analysis Tool (SAT) results are used within the Shared Vision Model (SVM) to compare shore protection costs for different regulation plans and other water level management scenarios.

Work regarding low water and flooding impacts is being undertaken within an ongoing project for study sites on Lake Superior, Georgian Bay, and Lake St. Clair to test detailed impact evaluation model methodologies. Previous results by the Coastal Zone TWG suggested that small changes in the Lake Superior regulation plan will cause limited incremental difference in low water and flooding impacts. As such, the current effort is being undertaken to demonstrate how data management and modelling may proceed in these areas to support future adaptive management needs.

As the work of the Coastal Zone TWG nears completion, a variety of summary activities have been finalized. Coping zones were developed and documented to support the needs of the Adaptive Management TWG, comments from the peer reviewers on the low water submission were addressed, and summary documentation was prepared regarding site characterization. The TWG has also been finalizing metadata based on the work done over the course of the study and has neared completion of a summary document outlining the overall work planning and decision framework implemented by the TWG within the Study and the products that were delivered. These items will be finalized over the next few months.

#### **Commercial Navigation TWG**

The Commercial Navigation TWG has completed its refinements of the Great Lakes Navigation Model (GL-SAND) and the results found within the SVM match extremely well when evaluated with historic NBS.

#### **Ecosystems TWG**

*Performance Indicator (PI) Evaluations Completed*

PI evaluations have been completed for all sites by the Ecosystems TWG site coordinators. The TWG site coordinators completed field data collection and all site coordinators have provided water-level response curves and threshold analyses to the modelling contractors (LimnoTech). During the spring, the modelling contractors continued to work with the site coordinators to further develop and refine the algorithms and inputs necessary to complete the Integrated Ecological Response Model (IERM2). Based on these evaluations, high and low water thresholds and coping zones have been identified and incorporated into the model.

#### *PI Fact Sheets Completed*

In conjunction with IERM2 model development, each of the Site Coordinators has developed a set of PI Fact Sheets that clearly describe (and justify) site-specific PIs and associated hydrological attributes used to generate the water level response curves, thresholds, and coping zones. All of the PI Fact sheets have been completed to reflect any changes to the thresholds and coping zones, and will be made available to the Study Board and posted on the IUGLS SharePoint site to assist with evaluation of the regulation plans.

#### *IERM2 Model Completed*

The IERM2 model is now complete and is used by the PFEG and Study Board to evaluate the response of PIs, thresholds, and coping zones for individual water regulation plans for different net basin supplies. A report describing the development of the IERM2 was submitted for peer review on March 4, 2011. Comments were received, responded to, and a final report that incorporated the peer reviewer's comments was finalized and completed on June 24, 2011. Included as an appendix to that report are the PI Fact sheets.

#### *IERM2 Coping Zone Calculator Completed*

The modelling contractors developed a spreadsheet-based "Coping Zone Calculator" that duplicates the results of the stand-alone IERM2. The Coping Zone Calculator has been embedded directly into the plan evaluation software (SVM Model) that is being used to evaluate proposed Lake Superior water level regulation plans. Coupled with the creation of the Coping Zone Calculator, a Coping Zone Guidance document was created to summarize and describe the outputs of the IERM2 for the plan formulators (PFEG) and the Study Board.

Note: The documents described above were also provided to the Adaptive Management (AM) Group to assist with the identification of key ecological PIs as part the AM Group's risk assessment and plausibility analyses.

#### *St. Clair River Ecosystem Workshop*

In response to a request made by the IJC to the Study Board to explore possible ways to restore Lake Michigan-Huron water levels by placing structures in the St. Clair River, the

TWG hosted a workshop and produced a summary 'white paper' describing potential local environmental issues and concerns related to the placement of structures within the St. Clair River. In January, the TWG produced a draft white paper and on February 3, 2011, a St. Clair River Ecosystem workshop was held in Windsor, Ontario. A final St. Clair River Ecosystem Report was completed that integrated the white paper and results from the St. Clair River Ecosystem workshop. Portions of this report were incorporated into the St. Clair River Restoration Report released on May 26, 2011 that described the Study's efforts to evaluate possible Lake Michigan-Huron water level restoration strategies. Findings from the workshop indicated that even though there may be environmental benefits to Lakes Michigan-Huron, the environmental impacts to the St. Clair River and downstream connecting channels and Lakes could be significant.

### *St. Marys River*

Work on the St. Marys River is complete. A report on the St. Marys River ecological evaluation was submitted for peer review on March 21, 2011. Comments were received, responded to, and a final report that incorporated the peer reviewer's comments was finalized and completed on July 1, 2011.

U.S. EPA funded a Great Lakes Restoration Initiative (GLRI) proposal to evaluate how flows could be manipulated at the St. Marys River controlling works and hydropower facilities to enhance the effectiveness of the Great Lakes Fisheries Commission (GLFC) sea lamprey control program. This ongoing project was done in collaboration with the IJC International Lake Superior Board of Control, Ecosystems and Hydropower Technical Work Groups, Plan Formulation and Evaluation Group, and the GLFC (Dr. Mike Siefkes).

In March, the Great Lakes Fisheries Commission submitted a letter to the Lake Superior Board of Control describing the experimental work and requesting that peaking and ponding flows at the hydropower plants be modified to include peak flows during nighttime hours during the sea lamprey spawning run. The request was presented at the March 23, 2011 Board of Control meeting in Niagara Falls, New York and an additional water allocation was approved by the IJC to account for increased nighttime flows every other day during the months of May, June, and July at the Brookfield and Cloverland hydropower plants.

The sea lamprey experiments began on June 1, 2011 and were completed on July 31, 2011. The data collected are currently being evaluated. Preliminary results will be made available later this fall in time to incorporate into the Study's final report. Overall, cooperation between the Board of Control, Sea Lamprey Control, the TWG, and the hydropower plants was excellent during these experiments.

### *Other*

Members of the TWG participated in a technical session on Ecological Impacts of Great Lakes Water Levels at the annual conference of the International Association for Great

Lakes research May 30 – June 3, 2011 in Duluth, Minnesota. Session attendance was very good. In July, a TWG technical presentation was given on the ecological analysis and approach used during the Study at the Coastal Zone 2011 conference July 17 – 21 in Chicago, Illinois.

The TWG project manager (Dr. Scudder Mackey) participated in the Study's public meetings held this summer describing the Study approach and results to date. Numerous questions were asked by the public about environmental impacts (and benefits) of Lake Superior water level regulation. An additional public presentation was given at the Lake Erie LaMP public forum meeting held in Toledo Ohio August 26 – 27 at Maumee Bay State Park, Ohio describing the overall Study with a focus on the IUGLS Restoration report and what water level regulation means for Lake Erie.

Portions of the TWG work were incorporated into a climate change workshop/meeting held by NOAA and the National Wildlife Federation September 12 – 14 in Ann Arbor, Michigan. An IUGLS/ETWG presentation was also given at the State of Lake Michigan Conference September 27 – 28 in Michigan City, Indiana.

### **Recreational Boating, Cruise Ship and Tourism TWG**

The Recreational Boating, Cruise Ship and Tourism Technical Work Group reviewed and responded to comments posed by the Peer Review Group on the document submitted in early February 2011. The review and response have been posted on the Study web site. The TWG is developing metadata as part of the public access to information process. In addition to this piece the TWG has reviewed and commented on the Shared Vision Model as it pertains to recreational boating as part of the Stamp of Approval process.

The TWG has provided a list of documents and reports that have been produced during the study period and when they were produced which will be referenced in the Study's final report.

### **Municipal, Industrial and Domestic Water Uses TWG**

The TWG has completed all coping zones, PIs and contextual narratives and they have been submitted and incorporated in the SVM. The co-leads have reviewed portions of the SVM that use the Water Use information. Notably, the information came from very few surveys (39 facilities). However, the major water supply facilities, serving over 85% of the total population dependent on Great Lakes water supply, were included.

Metadata for the TWG and all reports and files that do not have access restrictions have been added to SharePoint server. Those reports and files that have access restrictions have been sent to the IJC, Canadian Section (Mr. John Yee).

### **Hydropower TWG**

A report "Emergency Measures and Dam Safety Pertaining to Structures in the St. Marys River" has been prepared. It gives an assessment of the risk of overtopping the structures in the St. Marys River at Sault Ste. Marie, and whether existing structures can be modified to increase the Lake Superior outflow during emergency situations, including a possible new spillway. The report also reviews other possible emergency structural measures identified in previous reports (1987 and 1993) to alleviate the adverse effects of extreme high and low water levels.

The report describes the current flow apportionments of the St. Marys River and their genesis traced back to the IJC Orders. Of particular note are the flows for the Fishery Remedial Works which were an outcome of a multi-agency study/discussion led by the IJC in the 1970s and early 1980s. The report also reviews the various structural options listed in the 1993 Crisis Conditions report and the 1987 Task Force report.

The present structures are expected to function properly as long as levels and flows are within the historic (post-1900 to present) range. But these structures, especially the Compensating Works, need regular maintenance/repair to ensure structural integrity. To deal with high water supplies more extreme than the past, modifications to the existing works at the Sault would have marginal water level effects and only construction of a new spillway can increase the outflow capacity by a measurable amount.

### **2.1.2 Integration Technical Work Groups**

#### **Plan Formulation and Evaluation TWG**

At its September 20-22, 2011 Board meeting in Chicago, ten alternative plans were considered including:

1. Rule curve plans (55Mod49, 129, PFN3, Nat64, PP, PPReg and 77B).
2. Interest Driven Plans (Bal26 an Interest Satisfaction-type model, Dr. David Watkins' levels optimization, Bryan Tolson's impact optimization).

These ten plans were compared to thirteen water supply sequences/ four very different futures.

Evaluation of the plans was based on eight criteria, previously agreed to by the Board:

1. Maintain Lake Superior between 183.86 and 182.76 m
2. Minimize disproportionate loss
3. Reduce net shore protection costs (average annual reduction)
4. Are levels balanced?
5. Compress MH levels
6. Increase navigation benefits

7. Increase hydropower benefits at Sault Ste. Marie
8. Minimize environmental impacts

Two plans showed most promise: Nat64D and Bal26. The UW (Tolson) plan is also very good and provides comparable results to Nat64D, but does not include shore protection benefits, and needs to be refined further. Upon further review, Bal26 resulted in very low Lake Superior levels to provide higher Lake Michigan-Huron levels in one, very rare dry stochastically generated event. The Bal26 Plan outflows during this event varied radically in response to varying NBS during the 3-year event. Bal26 in an extremely dry stochastic-generated scenario drops Lake Superior by about 30 cm to help Lake Michigan-Huron. Hence Nat64D was chosen over Bal26 as the tentatively recommended alternative, subject to further testing and refinement.

The Nat64D Plan, based on the adjusted pre-project stage-discharge relationship, offers a simpler approach in determining Lake Superior outflow releases than Plan 1977-A. It attempts to maintain much of the natural variability in lake levels, while being consistent with the capacities of the current discharge structures at Sault Ste. Marie, and winter restrictions on the flow to reduce the risk of ice jams and trying to prevent extreme levels. It strives to achieve systemic balancing (i.e., maintaining the balancing objective of the 1979 Order), while significantly simplifying systemic regulation calculations and providing net economic and environmental benefits relative to Plan 1977-A.

In the past six months, PFEG worked to provide the Board final versions of the information and tools it needed to make final decisions on a new regulation plan and supplementary orders at the September meeting.

Other highlights of the PFEG work included:

- Support for the April, June and September 2011 Board meetings
- Support for the Board's public consultations
- Shared Vision Model (SVM) stamps of approval received from each of the six "performance indicator" technical work groups
- Development of several different Lake Superior regulation plan options
- The creation of online, dynamic access to the SVM through the IJC

#### *Decision Support for the Study Board*

In each of the three meetings, PFEG addressed the final decision in different ways. In the April 2011 Board meeting, PFEG presented a hypothetical decision process on a series of regulation plans using an incomplete set of information based on net average annual navigation and hydropower (Sault Ste. Marie) benefits, improvements on IERM Zone C counts and lake level range compression (Superior and Michigan-Huron) as the primary drivers of plan rankings. PFEG also initiated a process to assure confidence in the SVM evaluations. Attention was drawn to six key IERM performance indicators (PIs) that

influenced the decision, and efforts were made to improve confidence in these PIs with the cooperation of the IUGLS study directors, Jim Bredin (Board captain for the IERM), the Ecosystems TWG, IERM modellers at LimnoTech and the particular researchers who presented those PIs. Two of the PIs were changed as a result; whereas SUP-01 and SUP-02 had previously returned “A-B-C” ratings, ranging from acceptable (“A”) through negative but tolerable (“B”) to causing long lasting and significant harm (“C”) the indicators are now numerical, with more gradated interpretations.

PFEG also worked with Board members Jim Bruce and Don Burn to improve confidence in the net basin supplies, and with Board member Jonathan Bulkley to improve confidence in the hydropower analysis. Both those processes have made progress and should be completed in October 2011.

At the June 2011 meeting, PFEG provided an in-depth explanation and comparison of the finalist regulation plans and asked the Board to comment on the decision framework and to use it to select a subset of the plans for final development and evaluation. The Board selected 77A, PP, 77B, 129, Bal 26 and Nat60 for further study.

At the September 2011 Board meeting, PFEG presented a full evaluation of ten plans, including 77A and two versions of ‘pre-project’ as references. The evaluation used an updated version of the SVM that combined the previous version’s pairwise comparison of plans for one net basin supply set in great detail with all-plan, all-NBS comparisons for four future scenarios using key performance indicators (hydropower and navigation benefits, shore protection cost changes, SUP-01 and SUP-02 metrics and reduction of Superior maxima). The SVM sectorial evaluations used essentially final versions of all performance metrics (although the hydropower benefit equation may change in part in October, it is not expected to change plan rankings). Based on this, the Board recommended a new regulation plan, agreed on changes necessary to the Orders of Approval, and approved a final test of the value of adaptive management of the regulation plan.

### *Stamps of Approval*

PFEG worked with the six technical work groups to revise the SVM to obtain their “stamps of approval”. “Stamps of Approval” represent an internal peer review process that verifies the algorithms developed for the Shared Vision Model faithfully represent the analytical outputs of the parent models and information developed by each of the TWGs. The model reflects a very thorough peer review process to ensure that the evaluations of the parent models are correctly synthesized within the SVM. The stamps signified that the sectorial experts agreed that the SVM:

- correctly calculated their performance indicators, emulating any predecessor models correctly,
- presented the most pertinent information in its displays, and

- lent itself to the correct application of their research findings in the Board's decision.

To obtain the **navigation** 'stamp of approval', the SVM and the GLSAND model each estimated the net benefits of three different plans, two very similar to 77A and one (55M49) quite dissimilar. The two models differed somewhat in their estimation of gross average annual shipping costs (\$2.8 billion for the SVM vs. \$2.6 billion for GLSAND); this was not unexpected because of necessary structural differences between the models. For instance, GLSAND distributes costs from light loading differently from the SVM, and the SVM considers channel depths in the St Marys River, whereas GLSAND considers just lake levels.

The estimates of net benefits for commercial navigation, which is the difference in costs between plans, were very similar. Both models showed that the benefits for Nat64D and Plan 129 were so small (both models estimated about \$50,000 per year for both plans, or about 0.002%) that they should be considered as indistinguishable from Plan 77A. Both models showed that plan 55M49 would have a small, but noticeable negative impact. GLSAND estimated impacts as negative \$1.5 million (-0.06%), the SVM estimated negative \$2.2 million (-0.08%). Confidence in these numbers can be drawn not just from the similarity of the model results but also the reasonableness of the outcomes. The water levels in plans Nat64D and Plan129 are very similar to 77A, while 55M49 allows slightly lower Michigan-Huron water levels which impact most ships that travel on Lake Superior, and the negative results are consistent with that.

The **Hydropower** TWG had previously revised and approved the regression equations used in the SVM to calculate hydropower benefits. Mr. Peter Yee, the Canadian Hydropower TWG co-lead provided his official 'stamp of approval' in September 2011, although PFEFEG is working with Board member, Dr. Jonathan Bulkley to resolve his remaining concerns about the fit of one regression to post 2004 energy production at the Canadian plant.

The **Coastal** 'stamp of approval' came with the help of Mike Shantz, the Canadian Coastal TWG co-lead, who modelled, modified or suggested modifications to the SVM, all of which were incorporated. Of particular concern were the shore protection cost estimates. While the SVM estimates were sound, the final plan selection used the estimates from a version that considered more structures.

'Stamps of Approval' for **Municipal & Industrial Water Use** and **Recreational Boating** were based on review of the SVM with those TWGs. No changes to the calculations were made, but in each case, the displays of those data were changed to address concerns about misinterpretation.

Dr. Scudder Mackey secured the 'stamp of approval' for the **Integrated Ecological Response Model (IERM)** as embedded by LimnoTech in the SVM.

Dr. Scudder Mackey contacted each of the primary site coordinators requesting them to verify and approve the PIs as implemented in the SVM/IERM2 model. He received affirmative responses from all of the site coordinators except one, who is now in Australia. In particular, the prime researchers for the PIs highlighted at the April 2011 Board meeting all verified their PIs and had no additional comments. Dr. Todd Redder (LimnoTech) reviewed the implementation of the coping zone calculator in the SVM model and he did not find any issues or problems. This stamp certifies that the ecosystem research developed to assess ecological responses to changes in Great Lakes water levels accurately reflect the "best available science" and have been properly implemented in the IERM2 and SVM models.

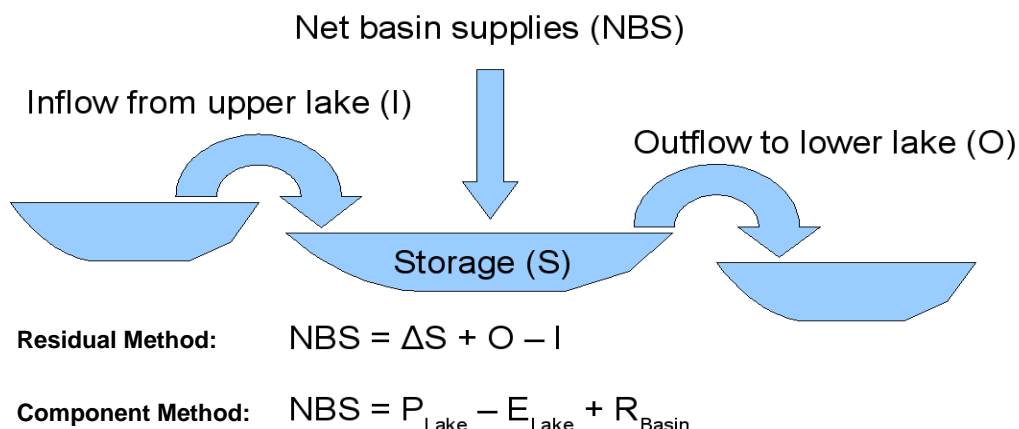
PFEG leads assisted in the preparation of the Study Board's public consultation process and attended public meetings to answer questions about the Lake Superior regulation plans and their evaluation.

### Hydroclimate TWG

The Hydroclimate TWG has been concentrating on preparation of its summary report dealing primarily with climate variation and the influence this may have on future Lake Superior regulation. Investigations centred on evaluation of water balance methodologies and examining climate variation through paleo (tree ring analyses), climate modelling and stochastic analyses.

Of particular interest has been the accurate closure of the Great Lakes water balance. Water balance, or sometimes referred to as a water budget, is an accounting of all water entering and leaving a given lake or, in this case, a system of interconnected lakes.

The figure below illustrates the two most commonly utilized methodologies for Great Lakes water balance accounting: the residual method, which is more indirect and is based on change in storage of the lake; and the component method which derives Net Basin Supplies using a water balance of the components of the hydrological cycle.



Since many key science questions facing the IJC and agencies operating within the Great Lakes basin are commonly addressed through understanding the water balance of the Great Lakes, a better understanding of this process and the methodologies used allows water management and regulatory agencies to more effectively manage the waters of the Great Lakes. This effort will result in improved hydrological forecasts, ecological restoration, water conservation, navigation and hydropower operations, and many other functions which benefit society.

A wide range of investigations were conducted to evaluate methodologies and data currently used for water balance computations in an effort to upgrade those measurements and computations. The findings have allowed improvements in both the data collection and methods utilized. In addition to the above efforts, studies were conducted to resolve uncertainties in estimates of the major components of the water balance. These studies have shed light on techniques that may reduce uncertainty in the overall water balance. However, a strategic investment in hydrometeorological research and monitoring in the Upper Great Lakes watershed is needed to address uncertainty in the estimation and prediction of key upper Great Lakes water budget components.

The TWG has identified possible contemporary climate variations as well as future climate change scenarios, which has resulted in the development of a number of supply sequences representing a wide range of plausible water supply scenarios.

Various methodologies were investigated in order to provide climatic scenarios for modelling present and future variability and change. The resulting climate scenarios are being used as input to hydrological models, as well as channel routing and lake regulation models. The sequences have been valuable in evaluating the robustness of various regulation options, exploring the plausibility of rare events and the evaluation of adaptive management strategies.

The climatic supply sequences developed included: historical supplies from 1861-1900, 1900-2008, and 1948-2008; Paleo sequences back 10,000 years; GCM/RCM climate change sequences; stochastically generated contemporary supplies; and stochastic supplies transformed by climate change.

Much of the work completed by the members of the Hydroclimate TWG has significantly advanced the science related to the refinement of the various hydrological factors affecting water supply and ultimately Great Lakes water levels. Noteworthy advancements in the field of climate science (climate modelling) were also made. As a direct result of these advancements, a number of scientific papers are being prepared and will soon be available to the greater scientific community.

## **Adaptive Management Group**

The Adaptive Management Group (AMG) presented its findings, conclusions and recommendations to the Study Board at their September Board meeting in Chicago for a long-term, post Study Adaptive Management (AM) program to support the Lake Superior Regulation Plan and beyond.

Since June 2011, the primary focus for the AMG has been on completing their final report and in finalizing their findings, conclusions and recommendations. To this end, the AMG has been holding bi-weekly conference calls since early April to prepare all of the components of their final report and to finalize their findings, conclusions and recommendations. The AMG has been focussing considerable attention on how an adaptive management program should function, under the auspices of the IJC, as well as other Great Lakes institutions, and they have considered a number of options over the past number of months. For example, the AMG considered an adaptive management committee reporting directly to the Superior Board of Control or the expansion and formalizing of the existing Coordinating Committee for Great Lakes Basic Hydraulic and Hydrologic Data. The first option was dismissed by the group as it was not felt that a committee reporting just to the Superior Board of Control would have the breadth to implement the proposed AM strategy. The second option, while a possibility, was not strongly supported among the members of the Coordinating Committee when the AMG met with them on May 17, 2011 in Ottawa. This was largely because this is an ad hoc group that has functioned for 50 years, and there was little appetite for taking on a broader mandate or becoming a formal entity under the IJC.

The option receiving the greatest support from the AMG members and the Study Board was to establish a new advisory board under the IJC to implement a Great Lakes – St. Lawrence River adaptive management program. This proposal was presented to the Study Board at their June 2011 meeting and received initial support. The concept is for a Great Lakes-St. Lawrence River Water Management Advisory Board to implement the AM strategy that is proposed by the IUGLS Study Board and the LOSL Working Group. The key elements of the AM plan are to include: Improved bi-national Great Lakes hydroclimate monitoring and modelling; improved tracking and understanding of physical changes in the system; more efficient information management and distribution; improved tools and processes for decision-makers; and improved governance for implementing an adaptive management program (including funding options). These will all be outlined in detail in the final AMG report and will be presented in Chapter 8: Adaptive Management – Strategy and Legacy of the Study Board's final report. This chapter was sent for peer review on September 19, 2011. Response from the peer reviewers, the Study Board and others will be taken into account before the finalizing of the report.

In the meantime, the AMG is continuing with their outreach activities to seek feedback from key federal agencies, states, provinces and regional and local agencies on the AMG strategy to seek feedback and input; help build momentum and support; and examine potential funding options. The AMG met with the Ontario Conservation Authorities on May 27,

presented at the IAGLR conference on June 1, met with state representatives and Ontario through a webinar on July 19, and held a circles of influence workshop in Collingwood in conjunction with the public meetings on Aug. 3<sup>rd</sup>. The general feedback has been very supportive and the AMG intends to continue with their outreach activities through to the end of the Study.

## **Information Management TWG**

The Information Management (IM) TWG held regular bi-weekly meetings via teleconference to oversee the implementation of the approved IM plan.

A metadata profile and supporting controlled vocabulary were defined and adopted by IM TWG members for use by Study participants during the metadata creation process. A spreadsheet tool was developed to help participants produce the required metadata. Metadata training sessions were held to support Study participants as they completed the required information. The resulting metadata records, approximately 150 to date, were incorporated into a publicly available search interface and catalog. This search portal relies on the *GeoNetwork* Opensource technology and is currently maintained by a third party organization: The Great Lakes Observation System (GLOS), on behalf of the IJC.

The IM TWG completed the delivery of a GIS Standard and Guidelines document. A data steward guide for study participants and long term stewards of study information and data should be completed before the end of November.

A significant challenge for this Study has been the identification of all key information/data and metadata assets, as well as associated stewards that support study work and recommendations. Without an information/data asset list, it is difficult to confirm that the Study has successfully documented all of its resulting assets. The absence of such a list also limits the requirements elicitation exercise needed to provide sturdy recommendations for post Study information/data management. As well, it was difficult to assess the level of effort required to perform metadata registration and management. Other options are being considered to elicit such requirements such as using the metadata records produced by study participants to generate an inventory of information/data assets.

The IM TWG will provide information/data management and stewardship options to the Study Board for consideration. These options will be based on the identified information/data steward, size, and need for availability both during and post study. It is expected that these options will be provided by the end of October 2011 for review by the Board. Study Board option selection is expected in November. This will leave, as planned in the IM work plan, the remaining months until the study end to implement the selected option. Implementation will include tasks such as engaging in licensing agreements with selected organizations to clarify responsibilities, securing long-term access and ensuring archiving of the data / information.

The IM TWG will also recommend that the IJC identify a post-Study mechanism to ensure appropriate post-Study coordination around stewardship responsibilities of all data assets. This role will be one of great importance for the Adaptive Management Group as well as for the Information Management and Decision Mapping System being developed by the IUGLS. The goal is for anyone to be able to easily access the information used to support the Study Board's findings and recommendations, and see clearly how the Board used this information. This system will map and link the data, models, studies and other information available from the Study to the decisions and recommendations that the Study Board will be making. Even if this system is currently in its preliminary stages of development, requirements must be included in the scenarios provided by the IM TWG.

## **2.2 Independent Peer Review**

Table 1 gives the status of the independent peer review of nine sub-products. The review of synthesis documents is on-going and is expected to be complete by mid-October.

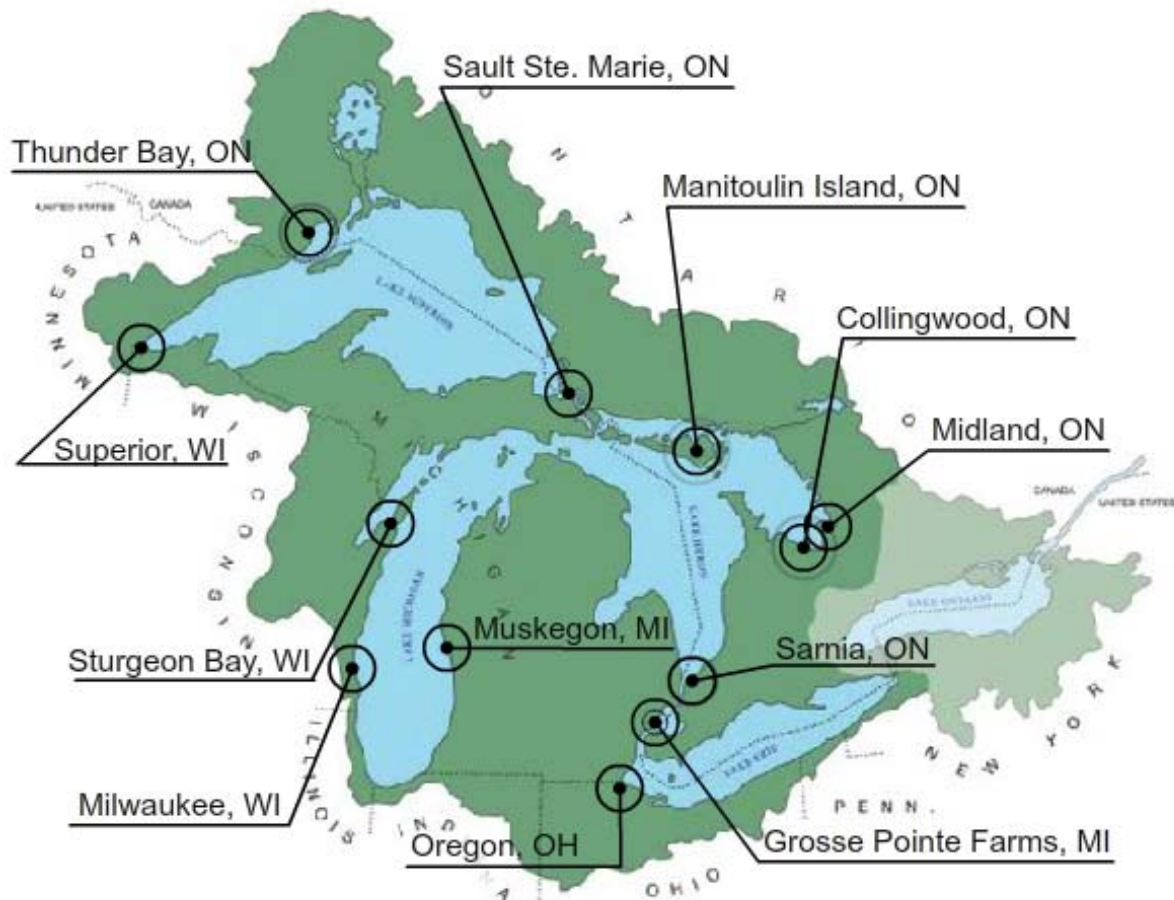
No.	Sub-Product Review	TWG/ Lead	Available	Report Status	Review Status US/ CDA	IPR Comments	Study Response	ASCE/ CWRA Posting	Comments	Closure
1	Economic analysis of Coastal Processes – Low Water Impacts	Mike Shantz/Eric Tauriainen	January 10, 2011	Submitted / with IPR	Complete	April 18, 2011	June 14, 2011	Awaiting posting on ASCE/ CWRA	Approved for posting June 26, 2011	Closed
2	Hydropower – Pricing	Peter Yee/Steve Rose	January 17, 2011	Submitted / with IPR	Complete	August 26, 2011			With TWG leads	
3	Recreational Boating Impact Analysis	Glenn Warren/Bill Boik	February 1, 2011	Submitted / with IPR	Complete	May 20, 2011	By September 30, 2011		Draft response complete - Finalizing	
4	Integrated Ecosystem Response Model IERM2 (Model only)	Joe Depinto	March 4, 2011	Submitted / with IPR	Complete	April 26, 2011	June 24, 2011	Awaiting posting on ASCE/ CWRA	Approved for posting June 28, 2011	Closed
5	St. Marys River for ecological restoration project, PI defined	Scudder Mackey	March 21, 2011	Submitted / with IPR	Complete	May 20, 2011	July 5, 2011	Awaiting posting on ASCE/ CWRA	Approved for posting July 15, 2011	Closed
6	Restoration Analysis	Study Team	April 8, 2011	Submitted / with IPR	Complete	May 6, 2011	May 26, 2011	Posted on IUGLS website June 10, 2011	Complete & posted	Closed
7	Hydroclimate – Climate Change (GCM/RCM)	Murray McKay/Brent Lofgren Debbie Lee/Al Pietroniro	May 16, 2011	Submitted / with IPR - June 14, 2011	Complete	August 17, 2011			With TWG leads	
8	Hydroclimate – Stochastic	Laura Fagherazzi/Taha Ouarda Debbie Lee/Al Pietroniro	April 26, 2011	Submitted / with IPR	Complete	June 13, 2011			With TWG leads	
9	Adaptive Management – Mitigation Plan (Multi-lake regulation /optimization)	Bryan Tolson	May 2, 2011	Submitted / with IPR - May 09, 2011	Complete	Sept. 2, 2011			With TWG leads	

Table 1 – Tracking Sub-product Review

## 2.3 PUBLIC INTEREST ADVISORY GROUP (PIAG) AND COMMUNICATION ACTIVITIES

The Study's Public Interest Advisory Group (PIAG) and communication advisers John Nevin and Jeff Kart spent the spring and summer working on several fronts to encourage participation in the public consultation process and to spur input from a broad range of interests and individuals regarding the Phase 2 portion of the Study. In addition, the communications strategy focused on providing information and raising awareness about the Study to the broader public.

To that end, advertisements were taken out in daily and weekly publications in the United States and Canada in advance of a dozen public input meetings held throughout the basin during the months of July and August. In addition, copies of a Progress Report offering the latest information on Phase 2 were inserted in many publications, reaching more than 100,000 people in both the U.S. and Canada. Facebook ads also were used to promote the meetings, reaching thousands of users, and PIAG members engaged their respective constituencies to spread the word about the events. Notices to the newspaper and broadcast press and an extensive media outreach effort resulted in major stories in all areas where meetings were held (see map).



A comment period for Phase 2 ran from July 18 through August 31, with opportunities to comment via an online form on the Study website, by email and by traditional mail. The communication advisors worked with a number of environmental and other interest groups to amplify promotions of both the meetings and the comment period. In total, more than 1,200 people attended the public meetings, and hundreds of other comments were received via phone, email, mail and the website form. In addition to Study-sponsored meetings, two other public sessions were sponsored by interest groups and presentations were provided by the Study Board. These additional meetings were requested by PIAG members and were held in Douglas, Michigan at the request of Roger Smithe of the Great Lakes Coalition and in Parry Sound, Ontario at the request of Christopher Baines of the Georgian Bay Association.

During the period, two new PIAG members were appointed by the IJC – Pat Madigan of Ohio (replacing Kate Bartter) and Mary Morgan of Wisconsin (replacing Jeff Vito). In addition, PIAG met in person in Washington DC on April 13-14 to consider public consultation plans for the summer and in Detroit on August 31 to discuss their views and comments from the public during the consultation. Via conference call, PIAG also provided extensive input to the presentation used by the Study Board at the public meetings.

## **2.4 STUDY MANAGEMENT**

### **2.4.1 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 October through December 2011 are shown in Appendix 2.

### **2.4.2 Budget/ Expenditures**

Tables 2 & 3 below show approved, committed and spent amounts in the U.S. and Canada from April 1 through September 30, 2011. The U.S. budget has been fully allocated for their fiscal year with the final tranche of \$16,391 received in September to complete the Study. Shown are the mid-year expenditures for the Canadian budget. At this point in time, there is about \$500,000 in funding that has not been allocated to address a specific Study requirement.

## **3. INFORMATION & GUIDANCE**

### **3.1 Information**

The Study Team is discussing with Dr. Peter Blanken of the University of Colorado and Dr. Chris Spence of Environment Canada – Saskatoon the establishment of two new eddy co-

variance evaporation gauges on Lake Michigan and Lake Erie. This will bring the total of Study-funded Great Lakes evaporation gauges to four, which will function through 2013.

### **3.2 Guidance**

The Study Team would like Commission guidance on the following issues:

- 1.** An Order of Approval is essentially predicated on historical conditions and comparable conditions that existed in the past. Increased climate variability and climate change may require 'switching options' as part of a plan to shift to operating modes for extreme conditions – particularly for drought conditions. Can a different regulation plan be triggered if it is anticipated that climate change will create conditions outside of the historical range?
- 2.** The Board is recommending a new Order to deal with such uncertain futures. Does the Commission agree with the flexibility required to deal with future climate uncertainty – or does it wish to restrict operations based on the historical record?
- 3.** The U.S. has spent more funds than Canada to date. Is this an issue with respect to balancing the budget for the Commission? Currently it IS possible that Canada may not fully spend their budget. There is about \$500,000 that has not been specifically allocated at this point in time. The Study will be presenting the Commission with a number of suggestions for spending these funds.
- 4.** The Study will be recommending the establishment of a permanent Great Lakes-St. Lawrence River Water Management Advisory Board. The Study will present the proposed mandate of this new Board at their appearance. The Study will be seeking the Commission's views on this Board and whether the Commission has the authority to create this Board.
- 5.** The Study will be presenting a case on the need for the Commission to maintain the data that the Study has collected. The Study will be seeking a commitment by the Commission to maintain these important data, especially in light of adaptive management.

Table 2 – U.S. (in \$1000US)

Activity	Budget <sup>1</sup>	Spent <sup>2</sup>	Committed <sup>3</sup>	Difference <sup>4</sup>
Study Board and Management	583	481.5	583.0	0
St. Clair Task Team & Hydroclimate TWG	259	245.2	259.0	0
Lake Superior Regulation Task Team	393	352.6	393.0	0
Plan Formulation /Evaluation & Adaptive Management TWG	139	139.0	139.0	0
Public Interest Advisory Group & Communications	140	137.4	140.0	0
Information Management	25	17.0	25.0	0
Peer Review Group	0	0	0	0
<b>Grand Total Budget</b>	<b>1,539</b>	<b>1372.7</b>	<b>1516.7</b>	<b>0</b>
Notes:				
1. Study Board budget				
2. Funds spent to date				
3. Funds committed through contracts or MOUs				
4. Difference between budget and committed/ spent to date				

Table 3 - Canadian Funding (in \$1000Cdn)

Activity	Budget <sup>1</sup>	Spent <sup>2</sup>	Committed <sup>3</sup>	Difference <sup>4</sup>
Study Board and Management	627	194.1	427.9	199.1
St. Clair Task Team & Hydroclimate TWG	110	27.4	54.9	55.1
Lake Superior Regulation Task Team	786	119.4	456.3	329.7
Plan Formulation /Evaluation & Adaptive Management TWG	60	0	0	60
Public Interest Advisory Group & Communications	50	20.8	20.8	29.2
Information Management	136	40.6	95.2	40.8
Peer Review Group	30	15.6	30	0
<b>Grand Total Budget</b>	<b>1,799</b>	<b>417.9</b>	<b>1085.1</b>	<b>713.9</b>
Notes:				
1. Study Board budget				
2. Funds spent to date				
3. Funds committed through contracts or MOUs				
4. Difference between budget and committed/ spent to date				

Respectfully submitted,



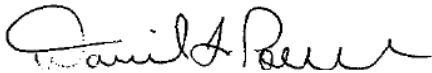
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GENE STAKHIV  
U.S. Co-Director



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TED YUZYK  
Canadian Co-Director



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DAVID POWERS



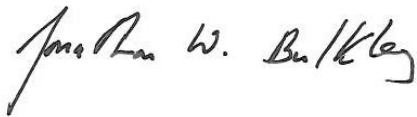
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JIM BRUCE



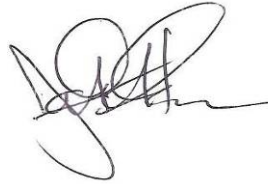
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JAMES BREDIN



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DON BURN



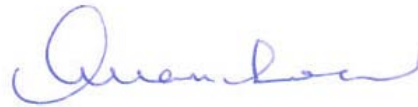
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JONATHAN BULKLEY



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JON GEE



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JOHN BOLAND



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ALLAN CHOW



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TONY EBERHARDT  
U.S. Study Manager

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SYED MOIN  
Canadian Study Manager

Appendix 1 – Meetings Held Related to the Study

	Apr 11	May 11	Jun 11	Jul 11	Aug 11	Sep 11
Study Board	Wash., DC (11-12)  IJC Appearance Wash., DC (13)		Niagara Falls, Ontario (7-9)  IJC Commissioner's Briefing (15)			Chicago (20-22)
TWGs		"SVAT" Workshop Burlington (10-11); Coordinating Committee & Hydroclimate TWG Mtgs. Ottawa (17-19)		"SVAT" Workshop Burlington (6-7)	"SVAT" Workshop Burlington (23-25)	
PIAG	Wash., DC (13-14)				Romulus, MI (31)	
Public Meetings	Congressional & Senate Briefings Wash., DC (14-15)		Douglas, MI (18)	Sturgeon Bay, WI (18); Milwaukee, WI (19); Oregon, OH (27); Grosse Pointe Farms, MI (28); Muskegon, MI (30)	Sarnia (2); Collingwood, ON (3); Midland (4); Parry Sound, ON (5); Manitoulin Is, ON (6); Superior, WI (9); Thunder Bay, ON (10); Sault Ste Marie, ON (11)	
Other		IAGLR 54 <sup>th</sup> Conference Duluth (May 30 -June 3)	CWRA 64 <sup>th</sup> Annual Conference St. Johns, NF (27-30)	CZ 11 Conference Chicago (17-21)		

Appendix 2 – Planned Meetings Related to the Study

	Oct 11	Nov 11	Dec 11
Study Board	IJC Appearance Ottawa (19)		Toronto (Nov. 29-30 & Dec. 1)
TWGs		“SVAT” Workshop (tentative) Burlington (8-9)	
PIAG	Ottawa (18)		
Other	IJC Bi-Annual Great Lakes Water Quality Meetings Windsor (11-13)	Coordinating Committee Mtg. Niagara Falls, NY (19-20)	