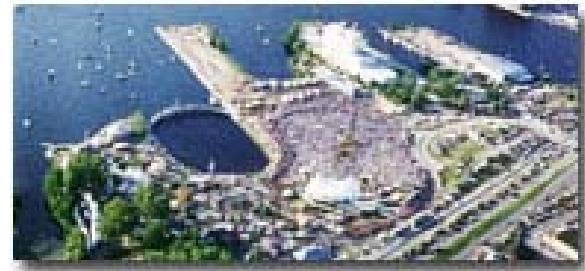


# International Upper Great Lakes Study

**Muskegon, Michigan  
Public Meeting  
May 3, 2008**



# Presenters

- **Kay Felt**
  - U.S. co-chair, Public Interest Advisory Group
- **Dr. Eugene Stakhiv**
  - U.S. co-chair, IUGL Study Board
- **John Nevin**
  - IJC Policy Advisor
  - IUGLS Communications Advisor



# Today's Presentation

- What is the IJC?
- Purpose and objectives of the Study
- Management and task structure
- Public outreach plans
- Previous work and recommendations of IJC
- The Baird Report
- IJC mandate limitations
- Science questions being addressed
- Work underway and expedited schedule
- Current conditions
- Conclusions
- Questions & comments

## International Joint Commission

- Established by Canada and US under the 1909 Boundary Waters Treaty
  - Prevents and resolves boundary water disputes
  - Authorizes projects affecting levels and flows in boundary waters



### IJC Orders of Approval

- Issued in 1914 for hydropower development.
- Led to Lake Superior outflow regulation.
- Protect interests in both countries affected by changes in water levels and flows

# IJC Orders of Approval

- **Created International Lake Superior Board of Control**
  - Oversees operation of approved works
  - Sets outflows and water allocation
  - Ensures accurate reporting of outflows
  - Advises IJC on outflow regulation
- **Supplementary orders issued in response to changing needs and conditions - latest in 1979**
  - Systemic Regulation – balance Superior and LMH
  - Range of 1.1 meters
  - Safeguard against high flows below structure
  - Safeguard against low Lake Superior levels

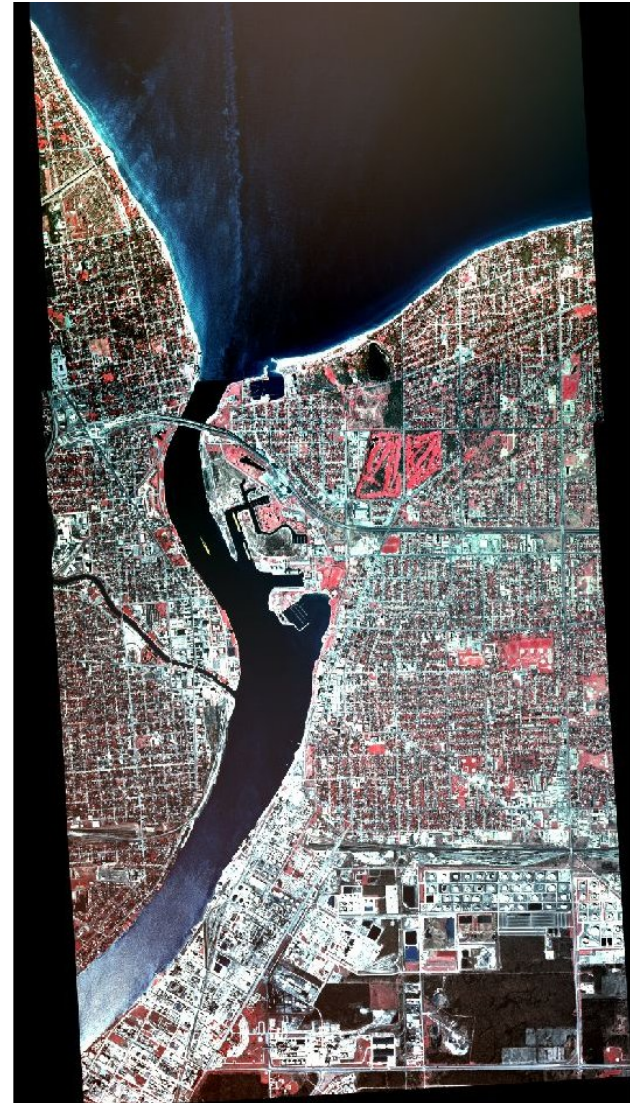
## Purpose of the Study

- Determine how water level changes affect resource groups including the environment.
- Develop improved knowledge of hydrologic and hydraulic processes of the Great Lakes system under the present climate regime and considering climate change.
- Involve governments, industry, academia and Native Americans and the public.



# Study Objective 1

- To investigate St. Clair River flow characteristics and determine how the natural regime of the river has been changed by human activities. Further on-going changes may change the water level relationship between Lakes Michigan-Huron and Erie.



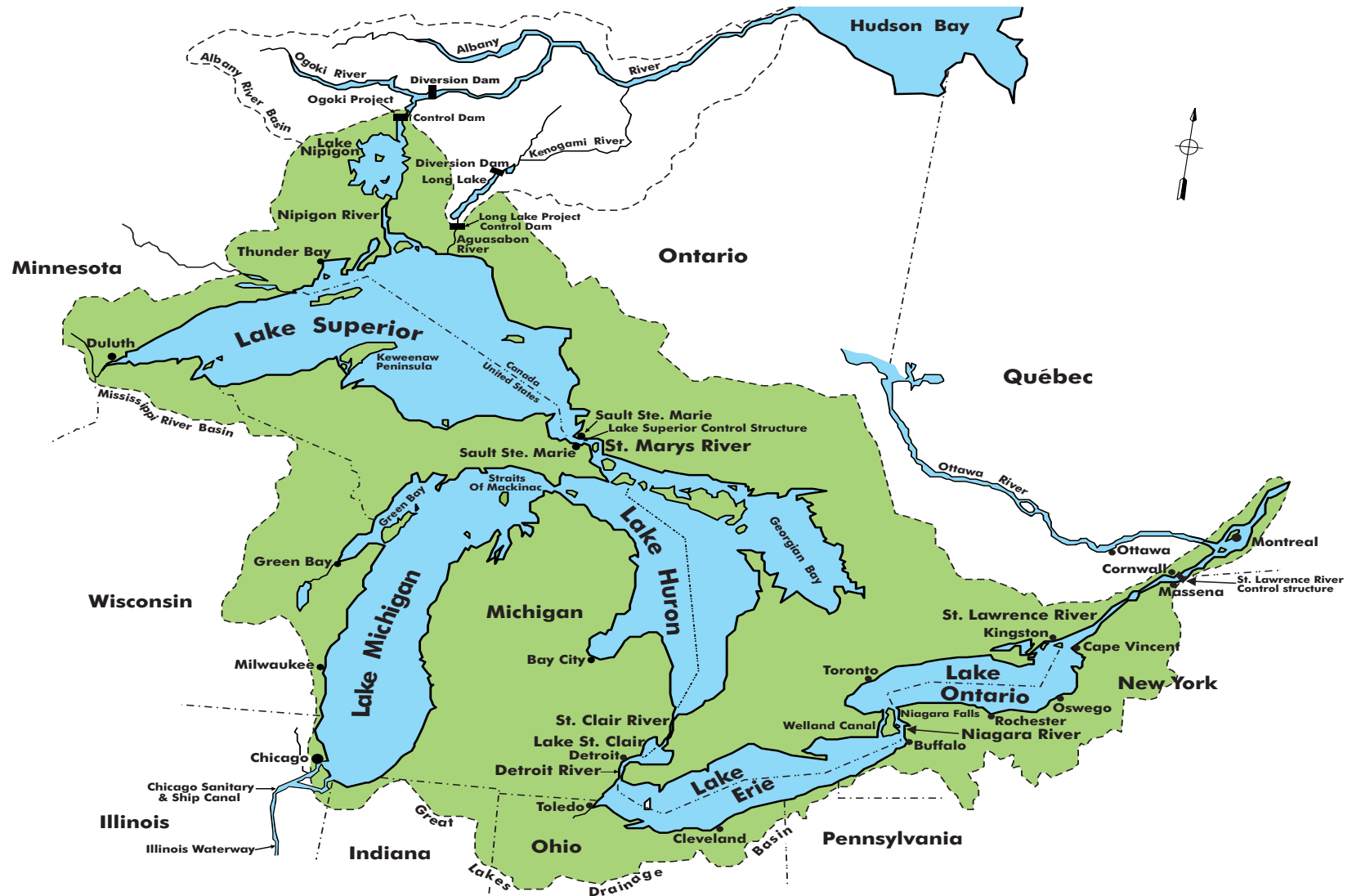
## Study Objective 2

- To investigate whether the current Lake Superior outflow management procedures could be improved considering evolving upper Great Lakes interests and climate change.
- To make recommendations to the IJC on changes and actions that may be necessary.





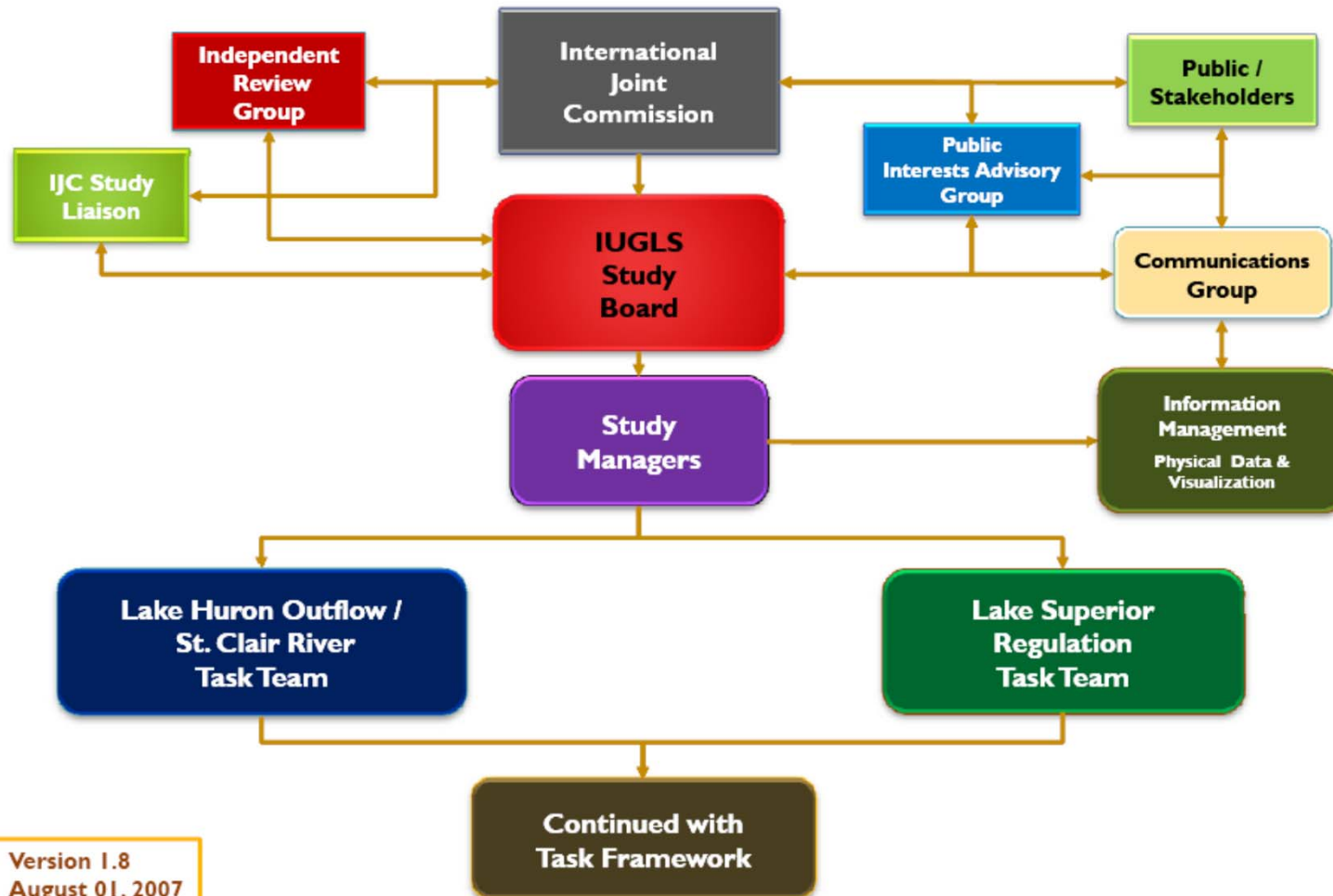
# IUGLS Study Area



# IUGLS Study Organization

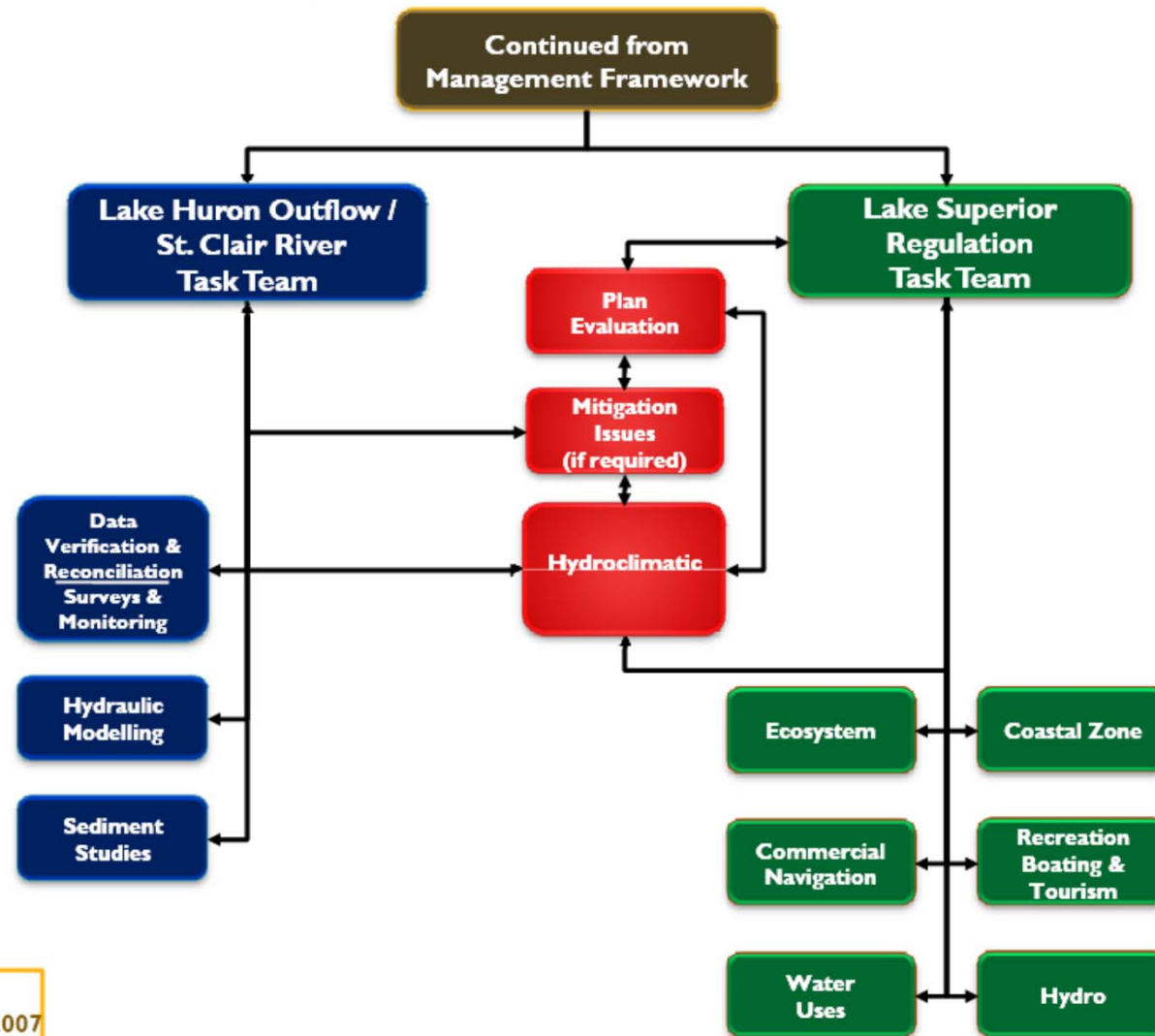
- **Binational Study Board**
- **Public Interest Advisory Group**
- **Independent Technical Peer Review**
- **Communications, Information Technology**
- **Technical Teams on Lake Superior outflow regulation and St. Clair River**
- **Technical Working Groups (Resource Evaluation Teams)**

## IUGLS Study Organization - Management Framework



Version 1.8  
August 01, 2007

## IUGLS Study Organization - Task Framework



## **Public Interest Advisory Group (PIAG)**

- **Gives public the opportunity to provide input to the study regarding values associated with different Great Lakes water levels.**
- **Provides vehicle for study to provide information to the public.**
- **Advises study on outreach and communications.**
- **Advises study on broad direction of work.**
- **Study benefits from experience and expertise of PIAG members**

## **PIAG Reflects Broad Range of Interests**

- **Ecosystem/environment**
- **Recreational boating and tourism**
- **Hydropower**
- **Commercial navigation**
- **Municipal, industrial and domestic water uses**
- **Coastal and shoreline interests**



## PIAG Membership

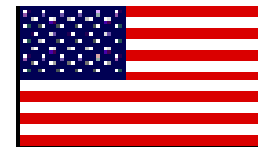
### Canada

James Bruce (**PIAG Co-Chair**)  
James Anderson, **Ducks Unlimited**  
Doug Cuddy, **Lake Superior Conservancy  
and Watershed Council**  
Dick Hibma, **Conservation Ontario**  
Kenneth Higgs, **Property Owner**  
William Hryb, **Lakehead Shipping Co. Ltd.**  
John Jackson, **Great Lakes United**  
Don Marles, **Lake Superior Advisory  
Committee**  
Mary Muter, **Georgian Bay Association**



### United States

Kay Felt, **Co-Chair**  
David Powers – **Save our Shoreline**  
Roger Smithe – **Int'l Great Lakes Coalition**  
Dan Tadgerson – **Sault Ste. Marie Tribe,  
Chippewa Indians**  
Alan Steinman – **Annis WRI**  
Samuel Speck – **Ohio DNR**  
Jim Weakley – **Lake Carriers' Assn.**  
Jeff Vito – **Cities Initiative**  
Dan Thomas – **GL Sport Fishing Council**  
David Irish – **boat shop owner**



# Outreach strategy highlights

- Public Meetings
- User-friendly web page – [www.iugls.org](http://www.iugls.org)
- Targeted interest-based workshops
- Regular progress reports
- PIAG liaison to Technical Work Groups
- Media briefings and education
- Congressional/Parliamentary Briefings
- Meetings with federal/state/provincial officials
- Newsletter

## Public Interest is High

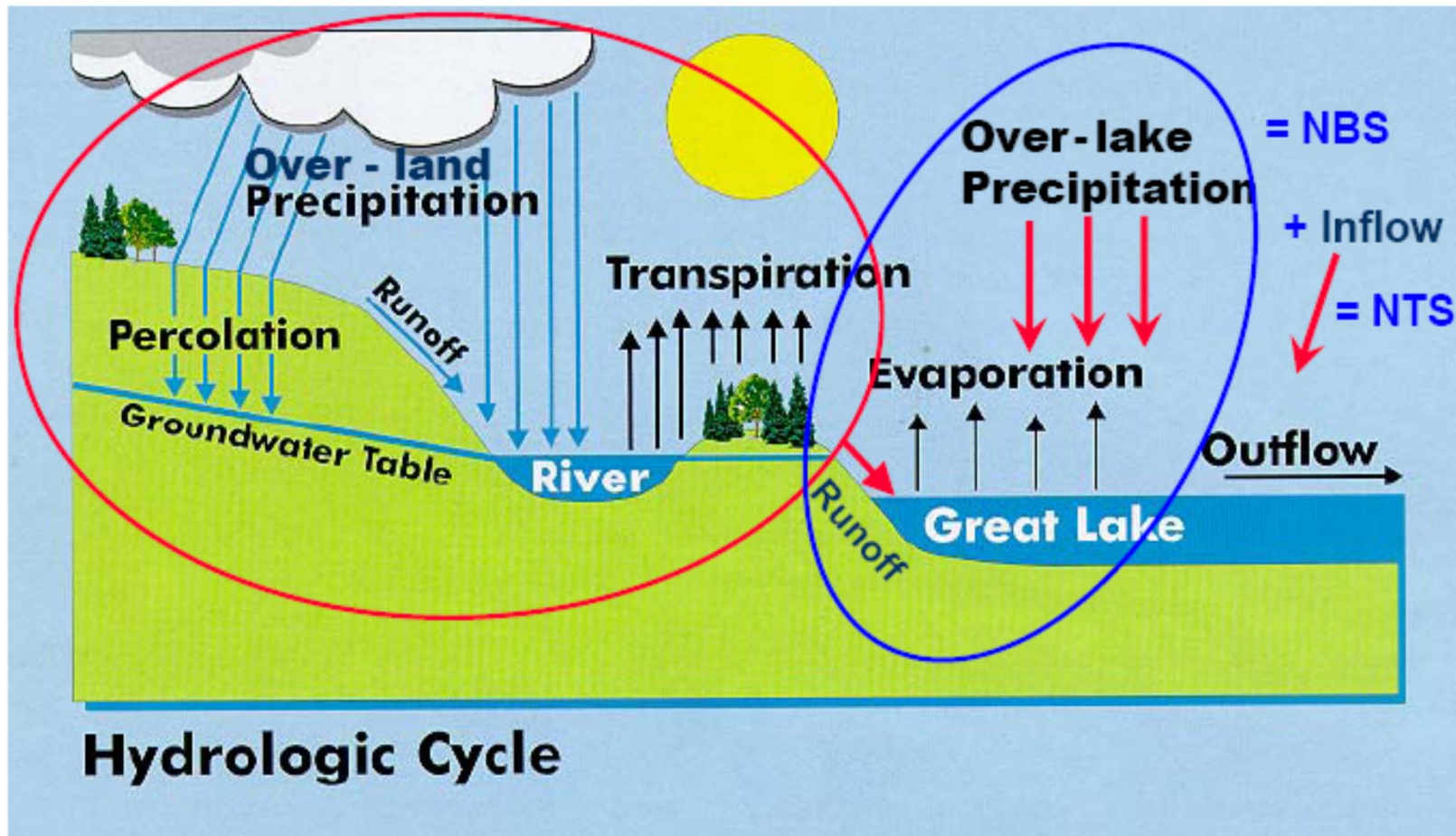
- **Seven Great Lakes senators wrote to IJC urging that the study be expedited and special attention given to public involvement (September, 2007)**
- **Senator Stabenow and Governor Granholm wrote to ACOE, asking them to investigate remedial measures that had been proposed in the 1960s.**
- **Great Lakes Commission wrote to ACOE, Environment Canada, and IJC begin investigations of possible remedial measures to address erosion.**

## IJC Alerts Governments regarding requests for immediate mitigation

In a recent letter to both governments, the IJC highlights the limitations of its mandate:

“The Commission’s authority under IUGLS with respect to flow capacity is limited to providing advice to governments on remediation options in the St. Clair River *where it is found that there are ongoing changes in the river bed*. The IUGLS is not set up to consider mitigation of low water levels regardless of cause, nor does the authority from governments to date provide for such. However, governments could provide the Commission with additional authority by issuing a formal reference, if desired.”

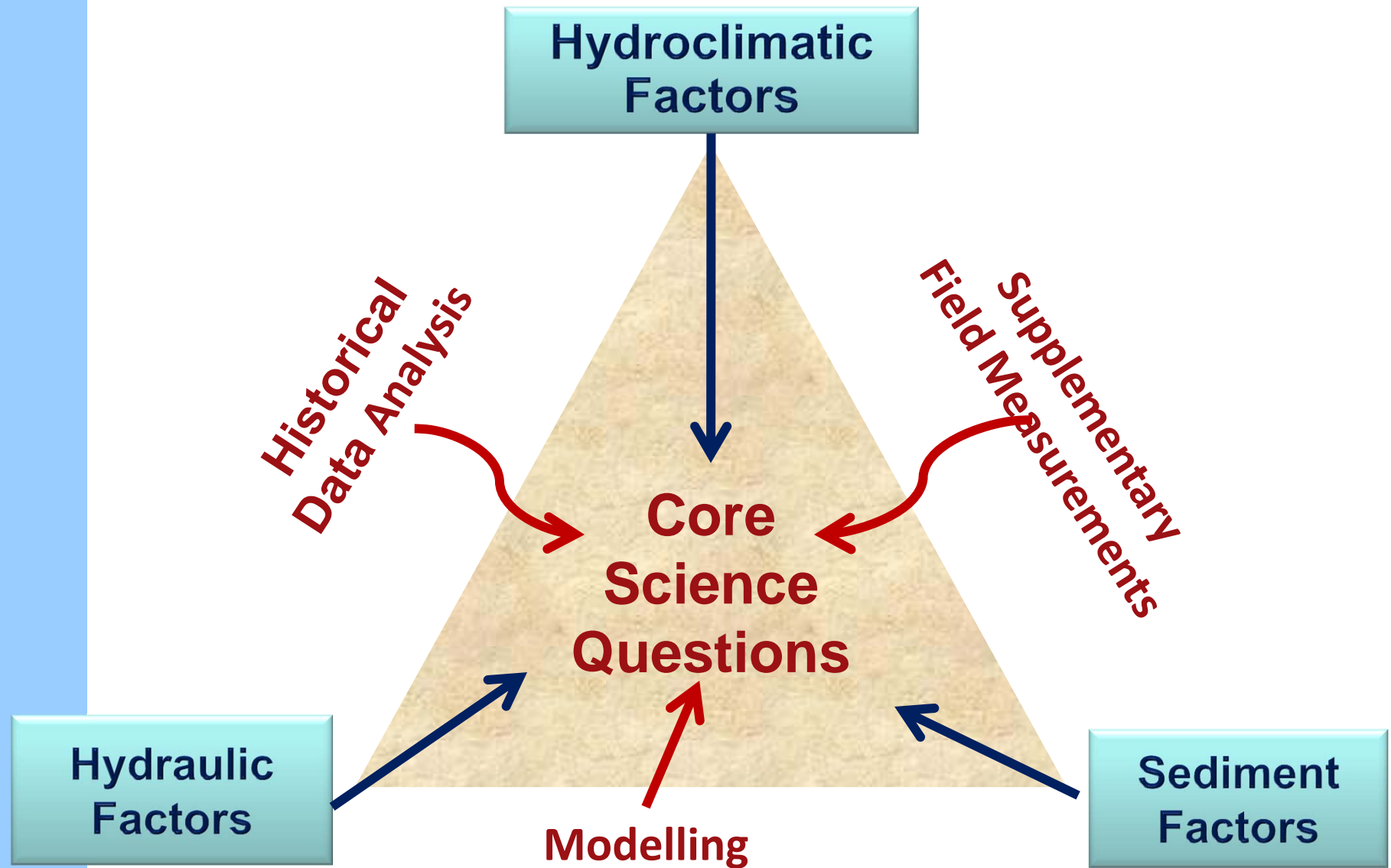
# Hydrologic Cycle



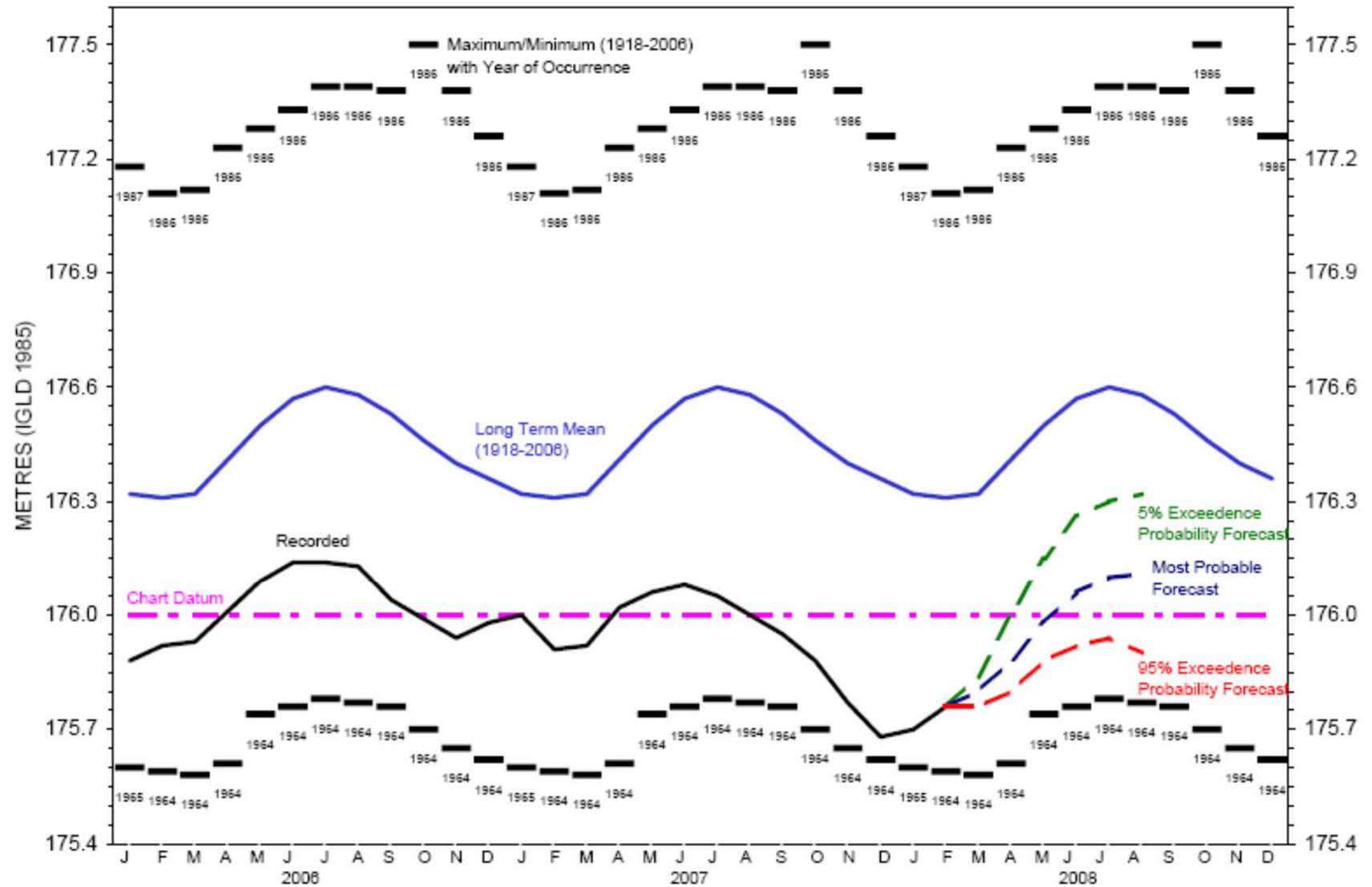
## Some Basic Facts

- Diversion of water from L. Michigan at Chicago = **3,200 ft<sup>3</sup>/sec** (90 m<sup>3</sup>/sec)
- Long Lac & Ogoki diversions into L. Superior = **5, 400 ft<sup>3</sup>/sec** (154 m<sup>3</sup>/sec)
- Flow through St. Clair R. = **188,000 ft<sup>3</sup>/sec (cfs)** (5,310m<sup>3</sup>/sec)
- 2 bgd 'loss due to 'drain hole' = **3,040 cfs** or 1.6% of daily St. Clair R. flow (GBA estimate)
- Avg daily evaporation from L. M-H ~ **87,000 cfs +/- 20%**
- IJC reports (2000) that in 1998, about **2.6 mill. gal** (~10 mill. Liters) of water were **exported** from the GL basin, while **37 mill. gal.** (141 MegaL) were **imported**.

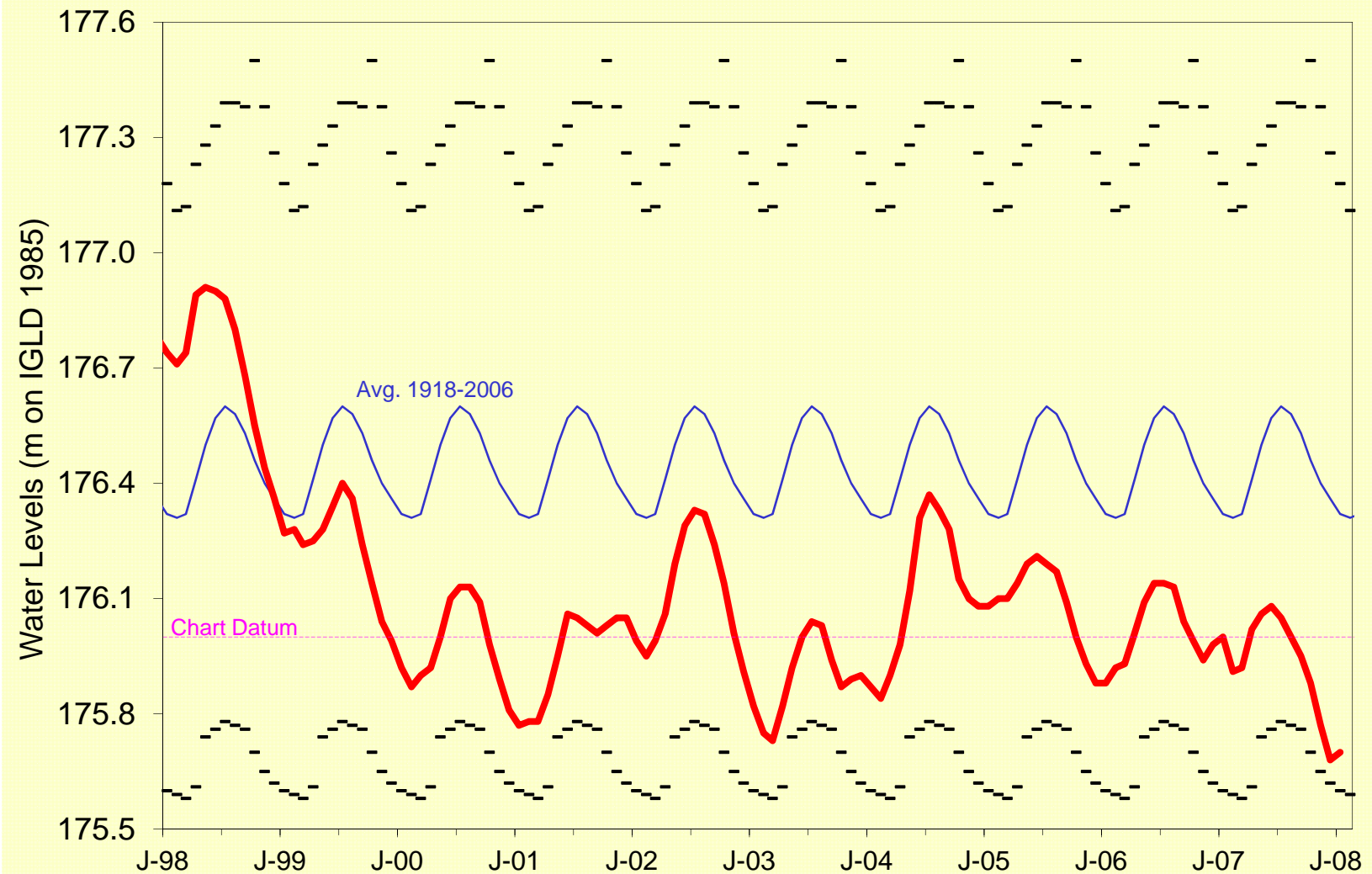




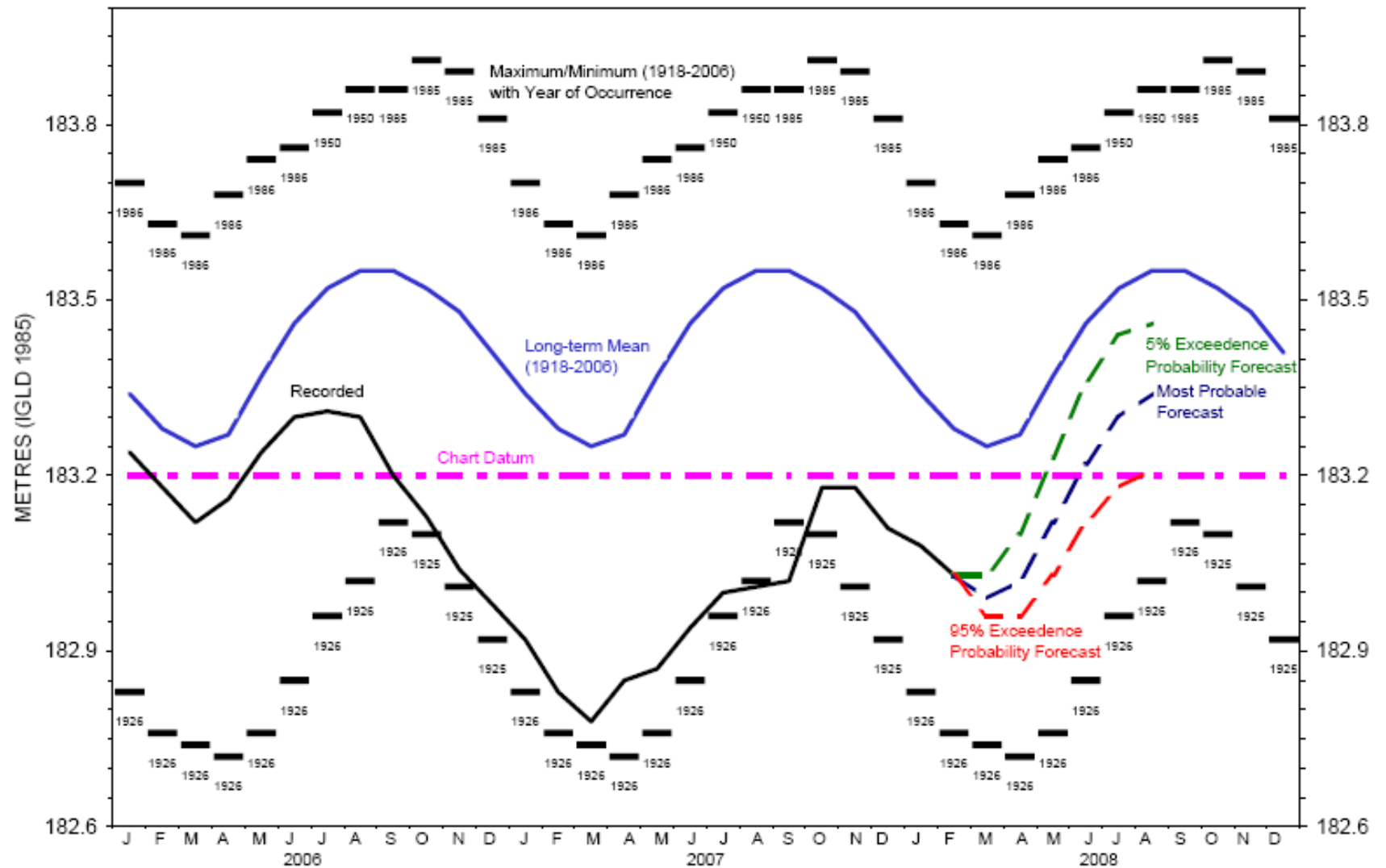
## LAKE MICHIGAN-HURON MONTHLY MEAN LEVELS



## Lakes Michigan and Huron 1998-2008

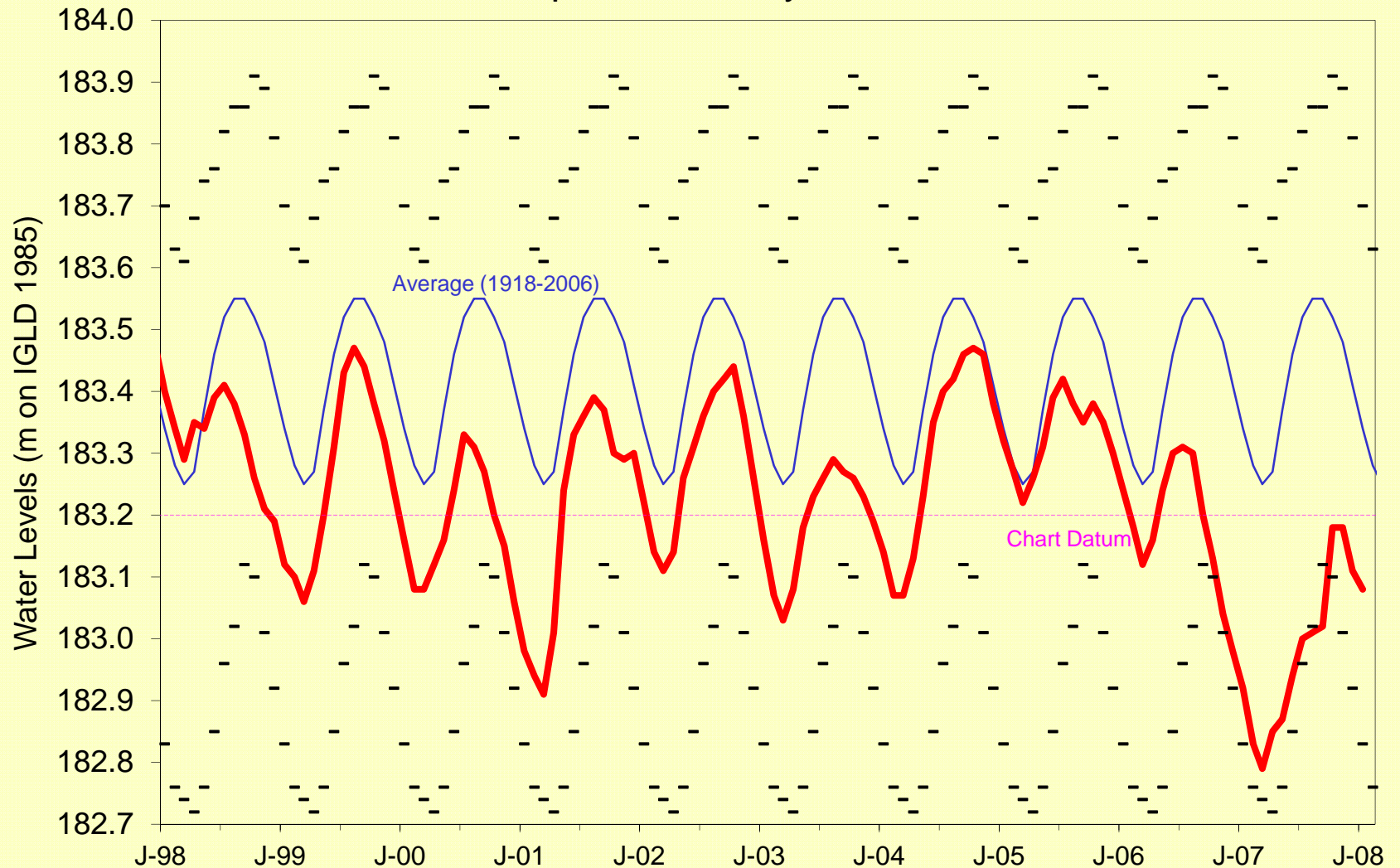


## LAKE SUPERIOR MONTHLY MEAN LEVELS



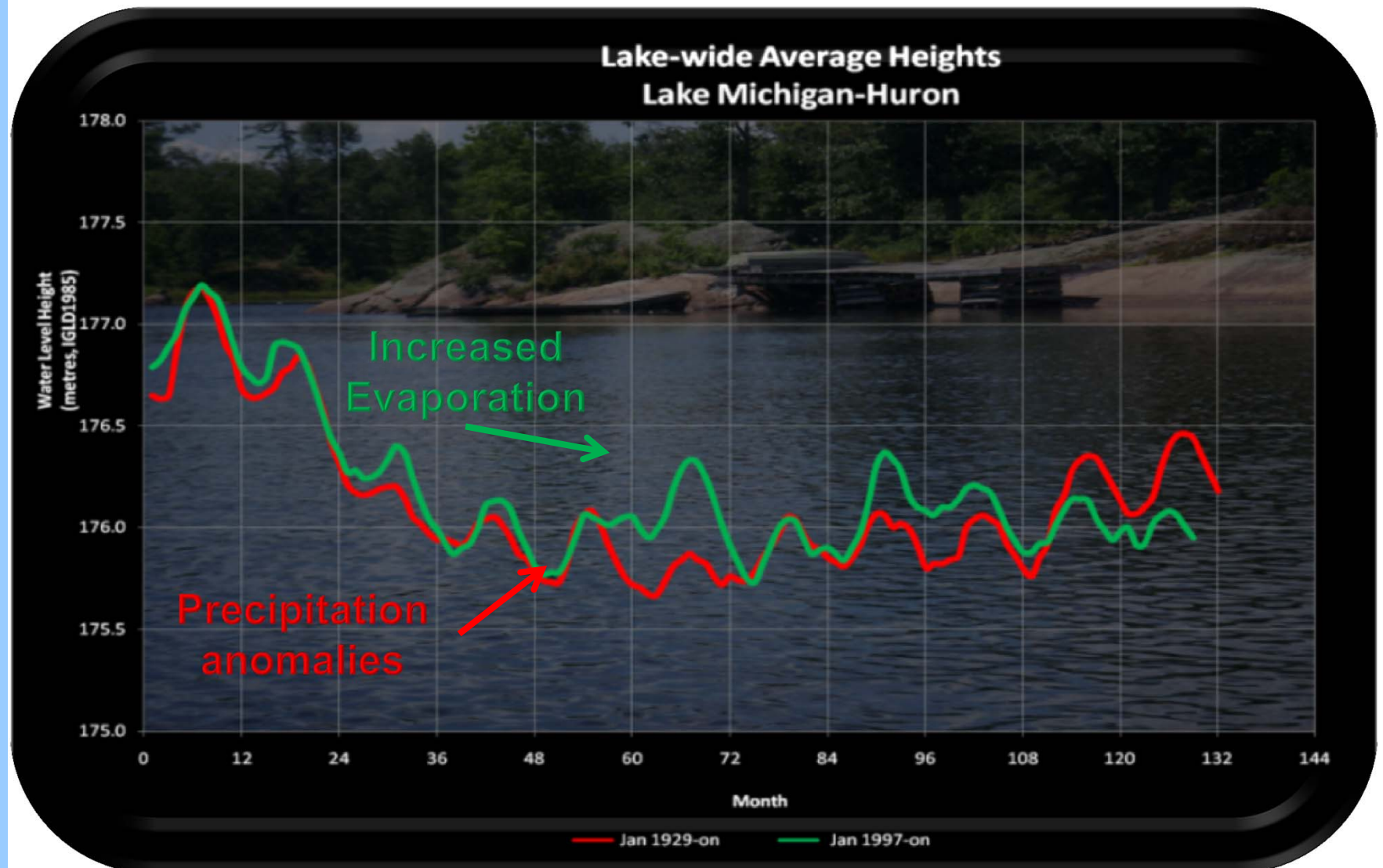
## Lake Superior 1998 – 2008

Lake Superior Monthly Mean Levels



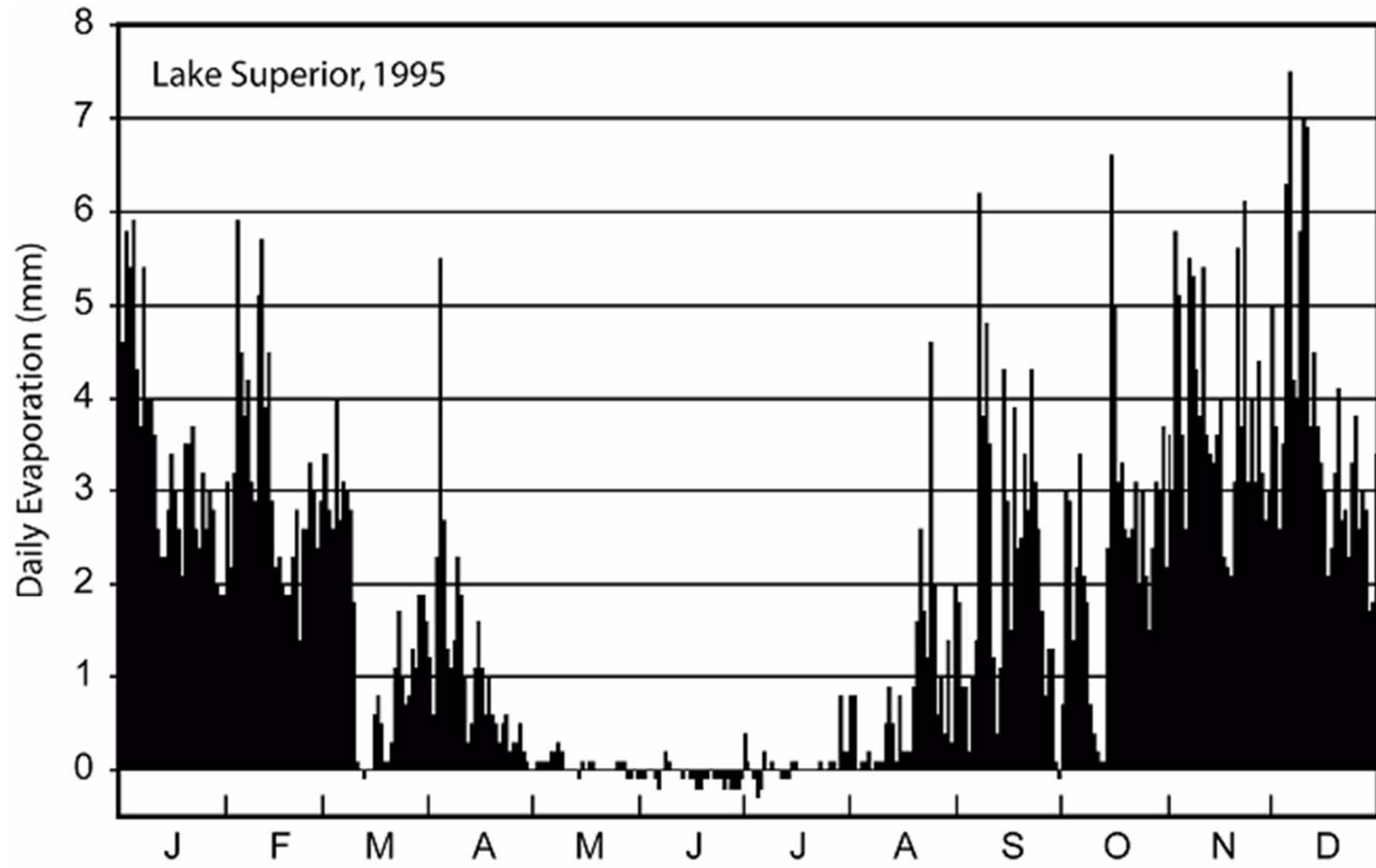


## Current era compared to “Dust Bowl”

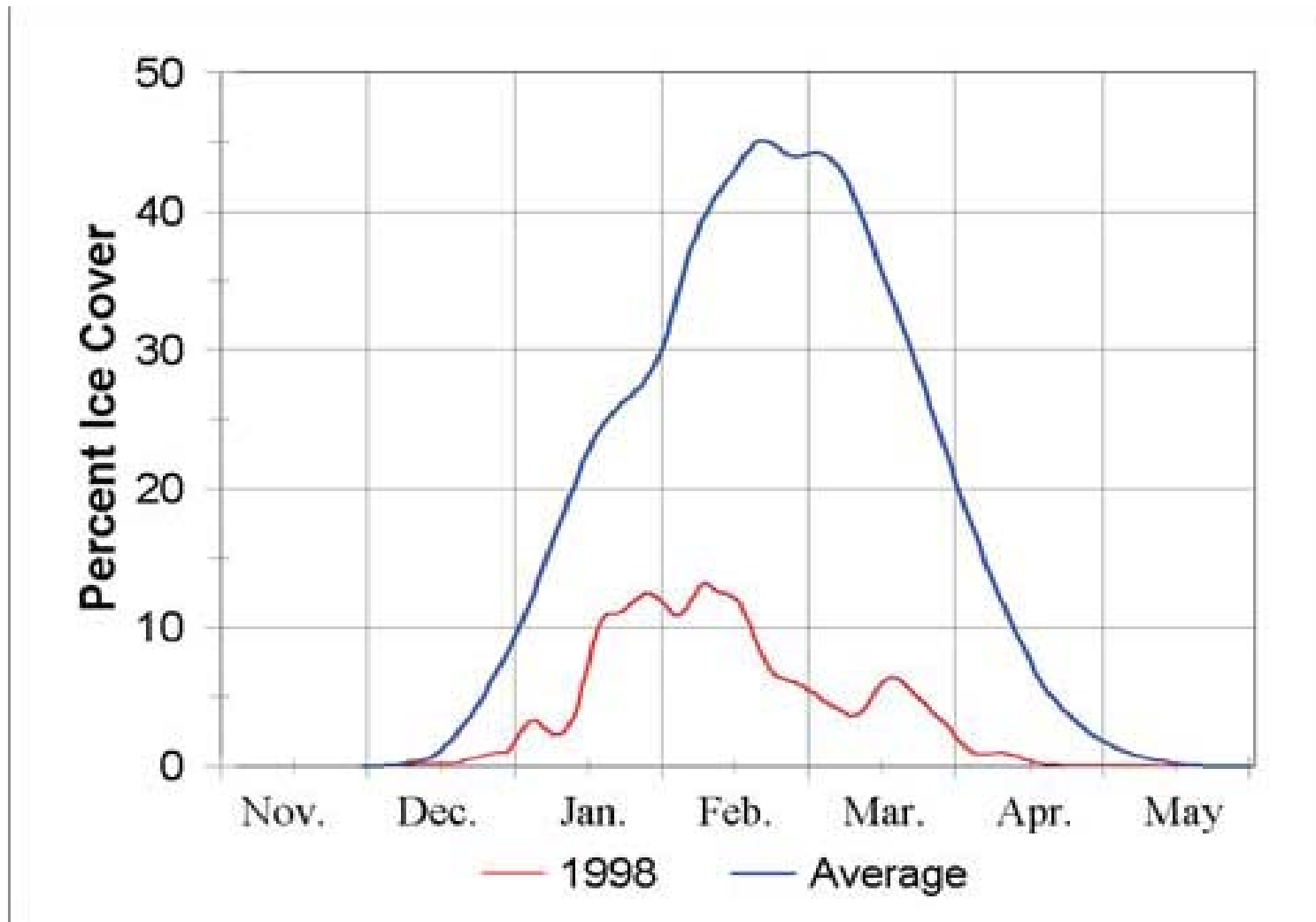




# Daily Evaporation, L. Superior

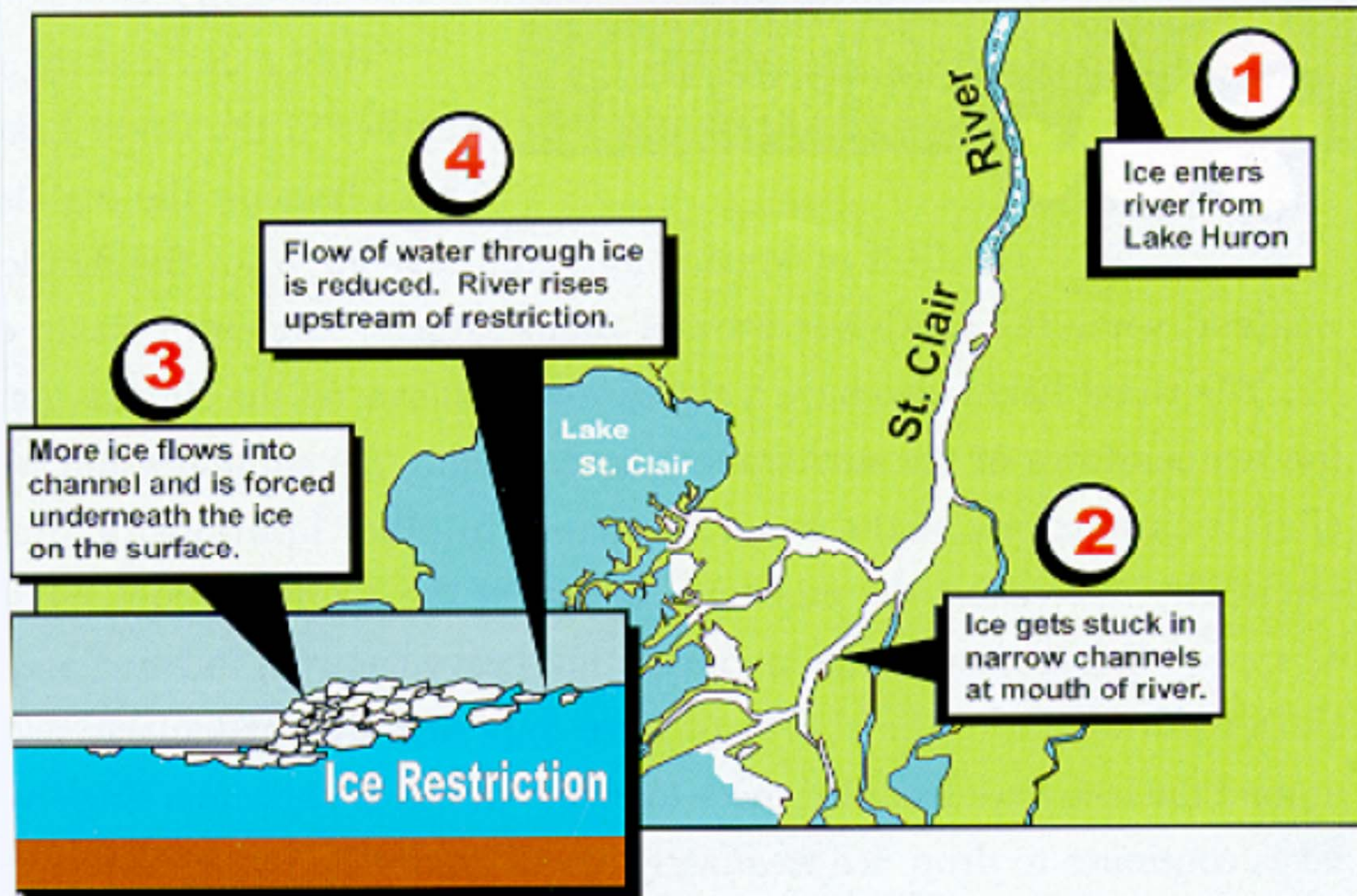


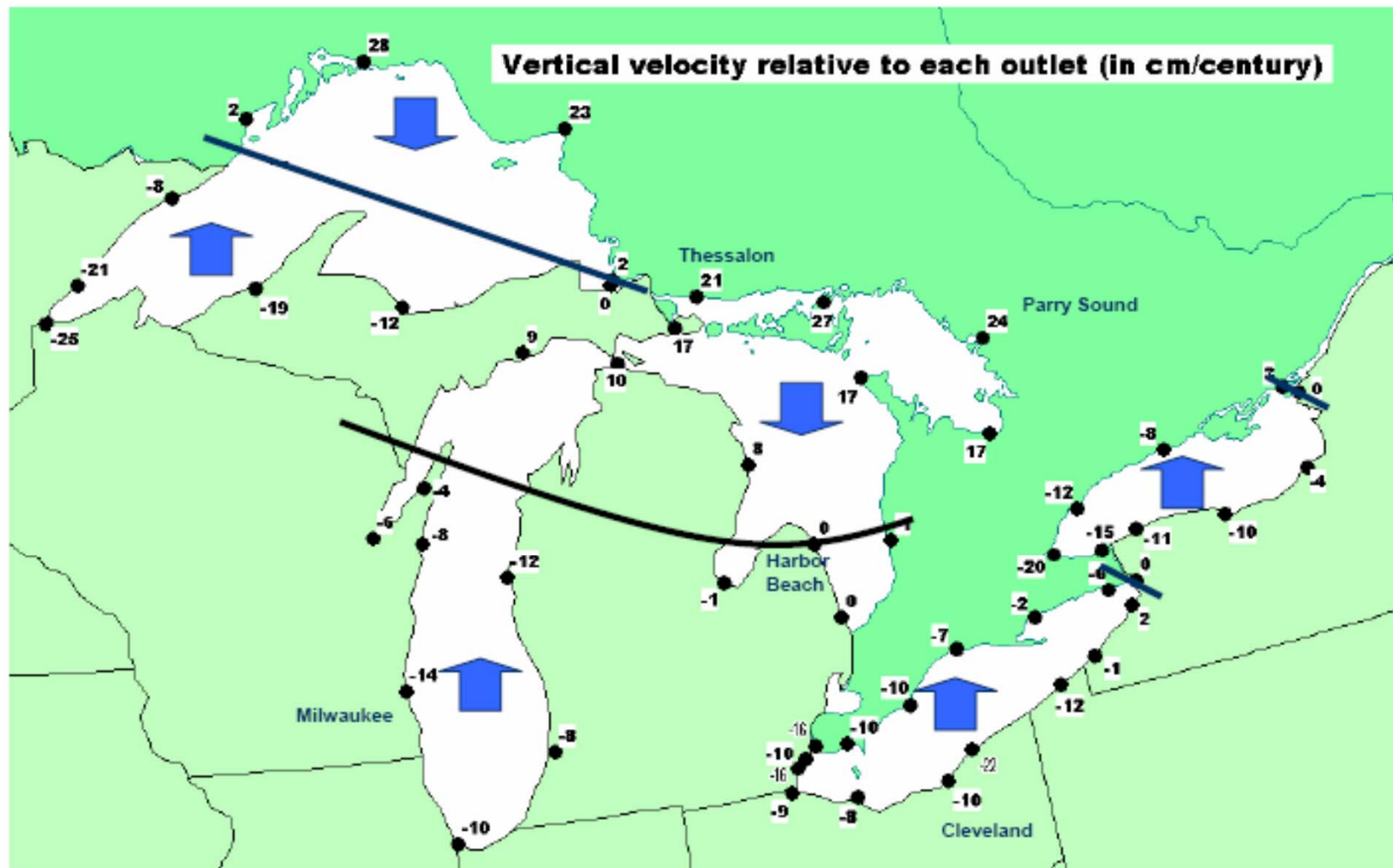
## Ice-covered surface area of Great Lakes



# Ice and Weed Flow Retardation

## How St. Clair River Flow is Restricted

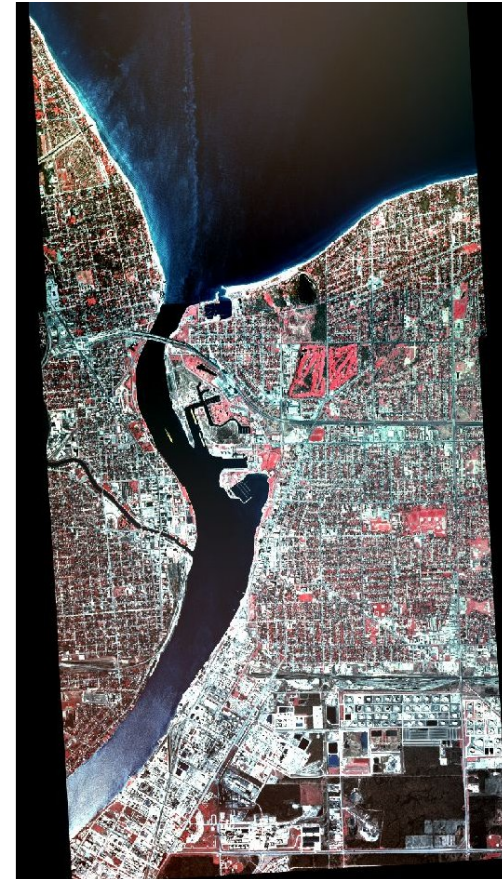






# St. Clair River Issues

- Recent low Lakes Michigan-Huron levels may not be entirely due to hydrology, but rather to ongoing physical changes in the St. Clair River
- Decline in water level difference between Lakes Michigan-Huron and Lake Erie since 1970 implies ongoing St. Clair River erosion (causes?).
- If a problem is identified, are there any remedial measures that could be undertaken?



## Understanding the St. Clair-Detroit River System:

- Investigate the factors affecting Great Lakes levels and flows, including physical changes in the St. Clair River related to:
  - Basin water supplies,
  - Diversions and consumptives uses,
  - Glacial rebound and subsidence (isostatic adjustments),
  - St. Clair – Detroit River **flow conveyance capacity.**



# St. Marys River at Sault Ste. Marie

(Looking East or Downstream)



## Improving Lake Superior Outflow Regulation:

- Review how the present management plan, Plan 1977-A, and the operation of the control structures affect water levels and flows.
- Identify potential updates and improvements to Plan 1977-A criteria, requirements, operating rules and outflow limits and incorporating operational experience.
- Review institutional arrangements.
- Test plan performance under climate variability and climate change scenarios.

# The Baird Report

Requested by the Georgian Bay Associations to investigate causes of the “significant and ongoing drop in the level of Lake Michigan-Huron relative to levels of Lakes St. Clair and Erie.”

## Conclusions

- Glacial rebound is negligible
- Net basin supply (NBS) shift unsubstantiated
- Primary cause is river bed erosion due to:
  - dredging of the 27 foot channel
  - loss of sand supply because of shore protection
  - Changes in the position of the outer channel

## Previous IJC and Board Report Conclusions

- Great Lakes must be managed as system, maximizing net benefits to all, without unduly harming any single interest.
- IJC has authority to revise “Orders” for **operating existing control structures**, but must refer all other new structural and non-structural measures that could alleviate damages to respective countries, states, provinces for implementation.
- Most proposed water control structures that could deal with extreme lake level fluctuations have benefit-cost ratio far less than 1.
- The Great Lakes are a large, self-regulating system and human intervention cannot significantly modify extremes.

## Science Questions Framework

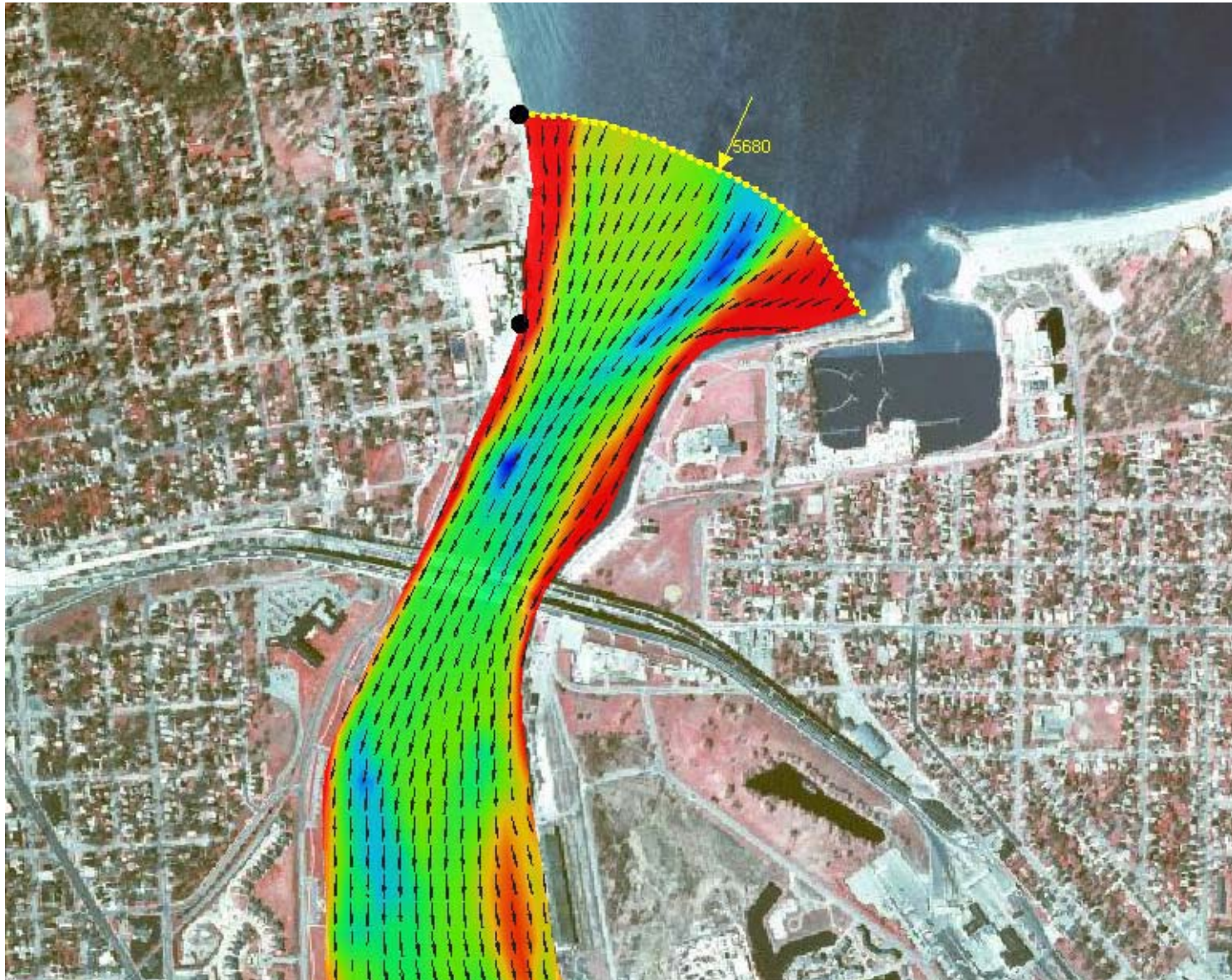
Has the <u>"Conveyance"</u> of the St. Clair River changed since the 1962 dredging?	SQ1	What is causing the declining head difference between Lakes Michigan/Huron - Erie?
	SQ2	Has the St. Clair River flow regime (i.e. water level-discharge relationship) changed with time and if so, why?
	SQ3	Has the velocity patterns in the St Clair River been modified and if so, what are the implications?
Has the <u>"Morphology"</u> of the St. Clair River been altered since the 1962 dredging?	SQ4	Is the St. Clair River bed stable or eroding?
	SQ5	If the bed of the St Clair river is eroding, what initiated it, and when?
	SQ6	Has the sediment budget for the St. Clair River changed and if so, what are the implications?





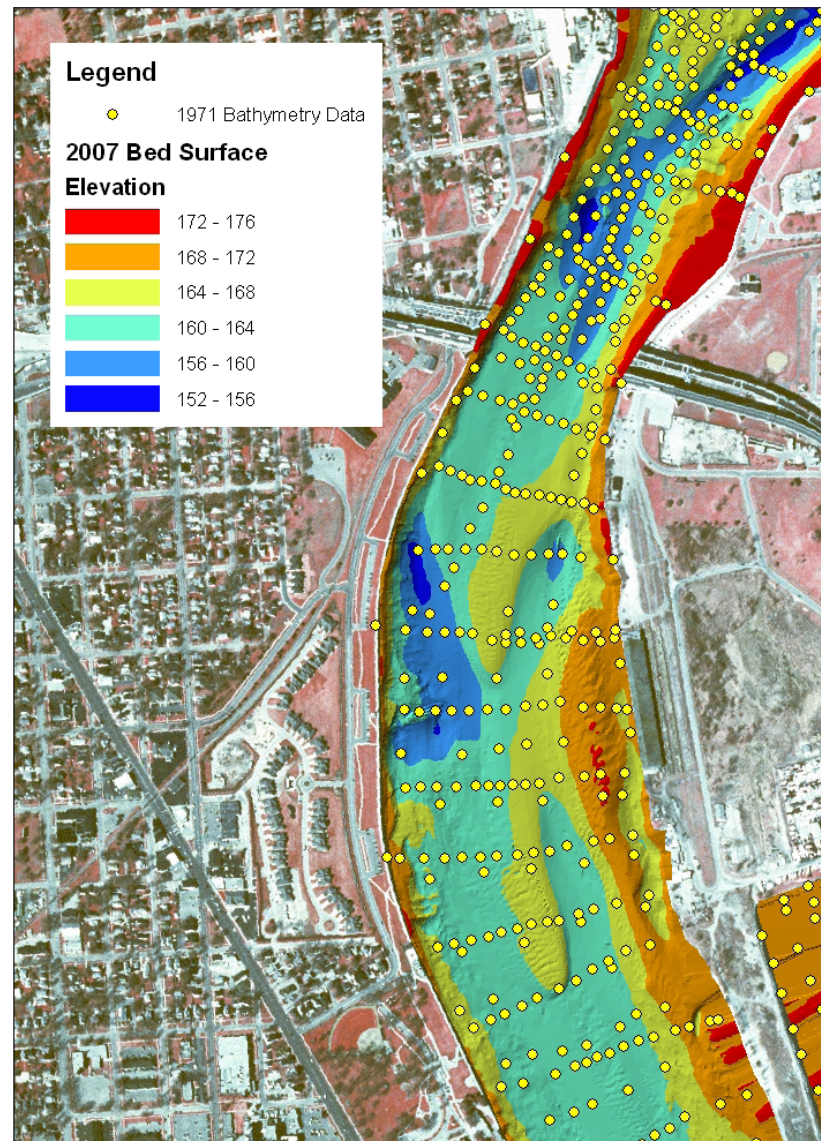


# Flow Features – Upper River





# Data Density Features – Upper St. Clair River 1971 profiles



**Table 2 - Result Integration - St. Clair River Tasks**

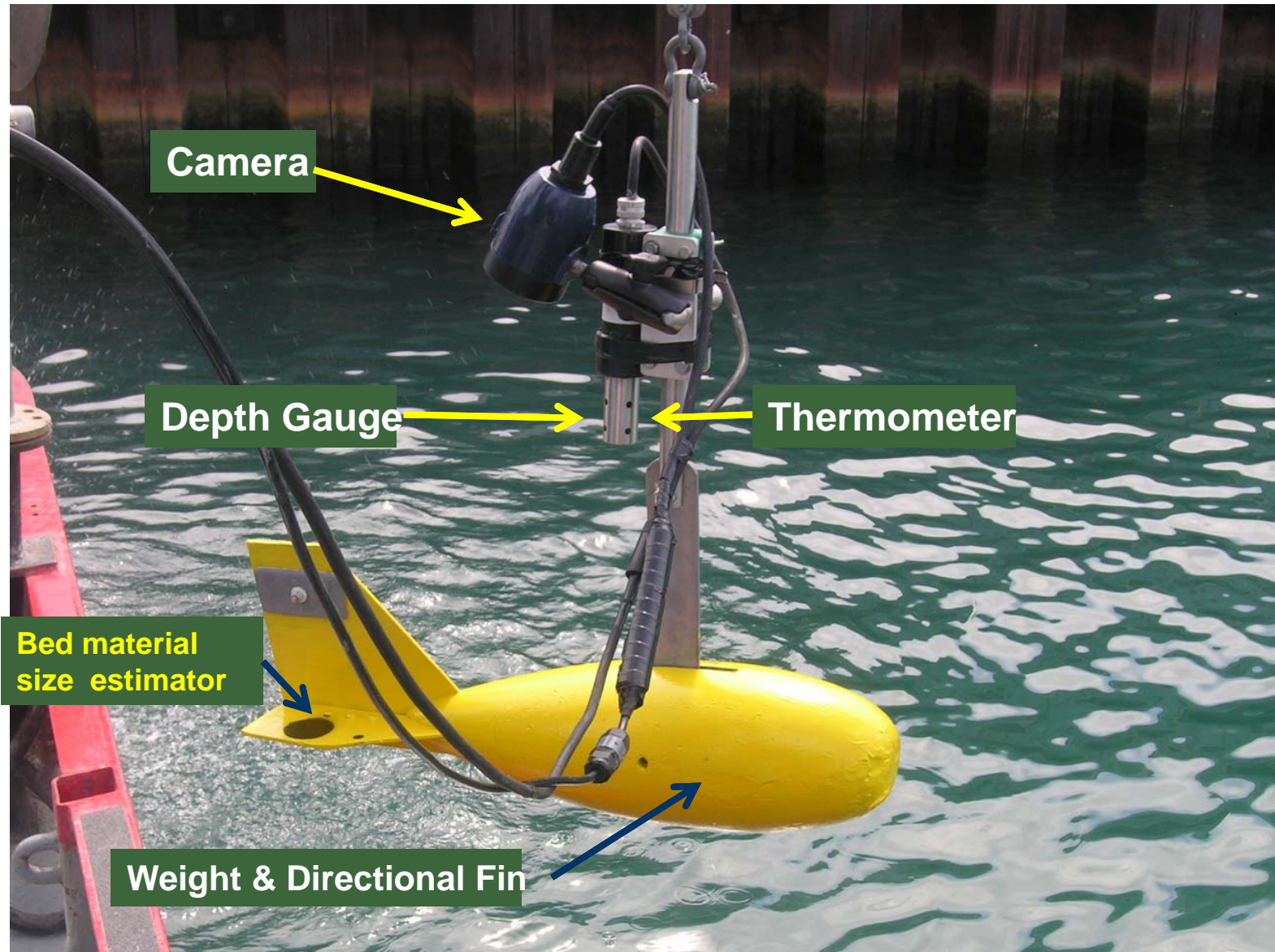
No.	Project	Science Questions Framework					
		Has the "Conveyance" of the St. Clair River Changed since the 1962 dredging?			Has the "Morphology" of the St. Clair River altered since the 1962 dredging?		
		SQ1 What is causing the declining head difference between Lakes Michigan/Huron - Erie?	SQ2 Has the St. Clair River flow regime (i.e. water level-discharge relationship) changed with time and if so, why?	SQ3 Has the velocity patterns in the St. Clair River been modified and if so, what are the implications?	SQ4 Is the St. Clair River bed stable or eroding?	SQ5 If the bed of the St. Clair river is eroding, what initiated it, and when?	SQ6 Has the sediment budget for the St. Clair River changed and if so, what are the implications?
P21	Net Basin Supplies Comparison and Water Balance Closure	☐	❖				
P22	Glacial Isostatic Adjustment	☐	❖				
P2	Review of St. Clair & Detroit River Rating Curves and Develop Hydraulic Performance Graphs	☐	☐		❖	❖	
P7	Discharge Computation of the River Using the Standardized HEC-RAS Model	☐	☐		❖	❖	
P3	Development of a Basic 1-D Modelling of St. Clair River Using HEC-RAS	❖	☐	❖	❖		
P4	1-D Conveyance Analysis of the St. Clair River Using the Standardized HEC- RAS Model	❖	☐	❖	❖		
P8	Ice Effects of Flows and Levels Using Standardized Geometry Model of HEC-RAS	❖	☐	❖	❖		
P10	1-D Conveyance Analysis of the St. Clair River using the Mobile Bed MOBED Model	❖	☐	❖	☐	❖	❖
P23	2-D Conveyance / Morphological Analysis of the St. Clair River using SED2D or equivalent	❖	☐	❖	☐	❖	❖
P5	Application of 2-D Modelling Using Existing RMA2 Model of the St. Clair River with Different Bathymetric Data Sets	❖	☐	☐	☐	☐	
P6	Application of 2-D Model of the St. Clair River Using Telemac Modules with Different Bathymetric Data Sets	❖	☐	☐	☐	☐	
P24	Quantification of Uncertainties in 1-D and 2-D Modeling	❖	☐	☐	☐	☐	❖
P1	Bathymetry of St. Clair River 1971 - 2007		☐		☐	☐	❖
P13	Analysis of Bathymetric and Planform Changes in the Past 130 years and Registration into Common GIS		☐		☐	☐	❖
P15	Obtain and Analyze the Bottom Velocity Data from ADCP		❖	☐	☐	❖	
P16	New Coincident ADCP and Multi-beam Data for Hydraulic/sediment Model Verification		❖	☐	☐	❖	
P18	Extract Bed Movement Velocity from Existing or New ADCP Data		❖	☐	☐	❖	
P11	Side-scan Sonar and Video of Substrate in Upper St Clair River		❖		☐	❖	
P12	Sediment Coring and Physical Testing of Substrate in the ST. Clair River		❖		☐	❖	
P9	Video Transects of River Bed, Monthly Sediment Load Measurements, Cross-section Surveys, Grab samples of Bed Material - Samia-Pt Lambton		❖		☐	☐	☐
P17	Analysis of Ship Effects, Both Movement and Sinking on Sediment and Erosion Regimes				❖	☐	❖
P19	Reports and Data on Surficial Geology, Littoral Transport, St Clair River and Delta				❖	❖	☐
P20	Conduct Sedimentation Studies of the St Clair River Delta		❖		❖		☐
P14	History of St. Clair River and Detroit River Dredging and Compensation Works				❖	❖	❖
Legend:							
Primary focus		☐					
Secondary focus		❖					
Projects not initiated - Will start this spring							
Matrix version 1.5 - Study Team - March 18, 2008							

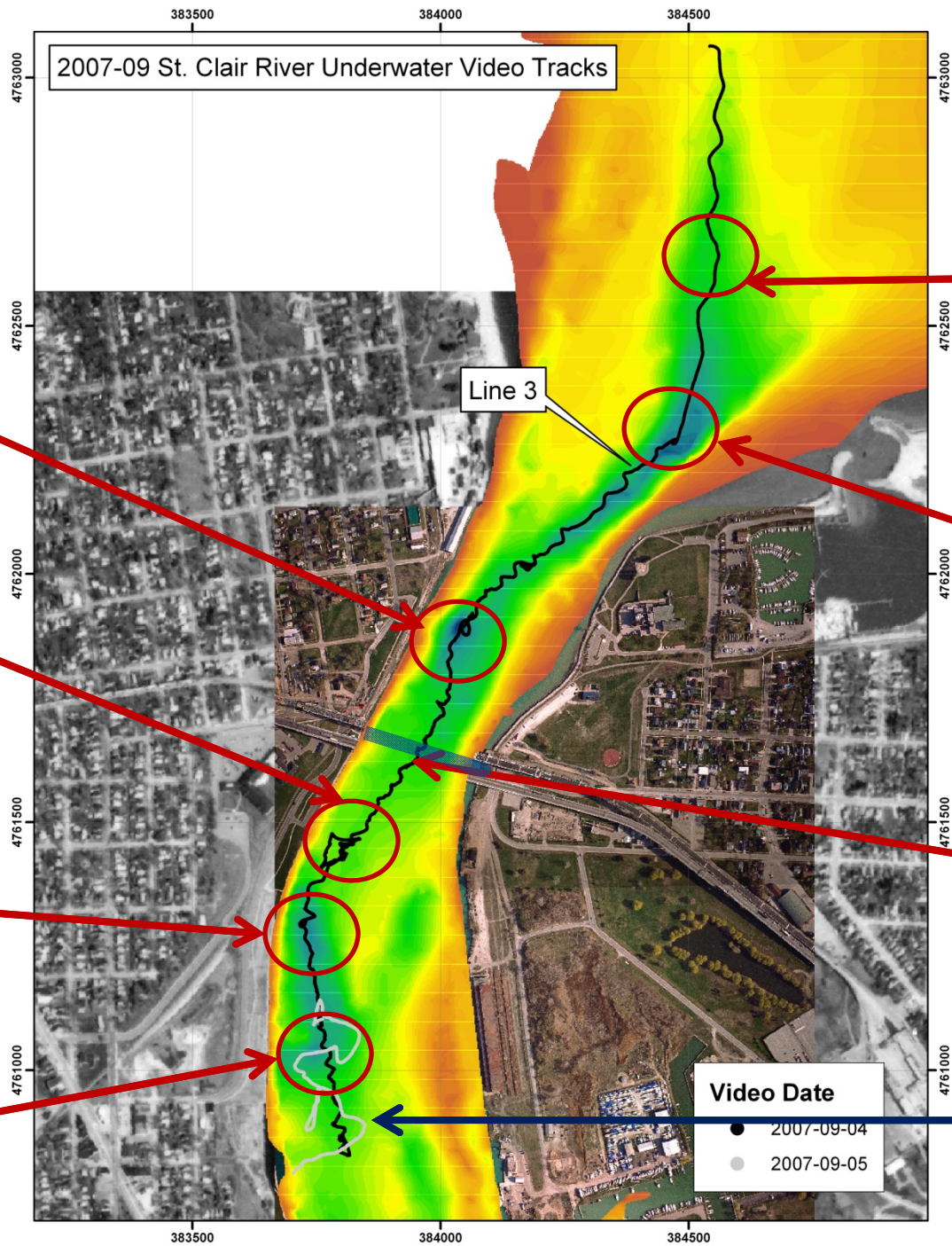


# St. Clair River Animation









Blue Water Bridge





## **Expedited Reporting Schedule**

- |                       |   |
|-----------------------|---|
| <i>April, 2008</i>    | <b>Interim Progress Report focusing on status of projects examining the conveyance and morphology of the St. Clair River, including hydraulic models and Net Basin Supply analysis.</b> |
| <i>October, 2008</i>  | <b>Interim Progress Report providing an initial assessment of science questions.</b>  |
| <i>February, 2009</i> | <b>Draft Final Report on St Clair River completed and distributed for comments to all the key groups.</b>   |
| <i>June, 2009</i>     | <b>Final Report for the St. Clair River portion of IUGLS submitted to the IJC.</b>  |

# Conclusions

- Study is well under way – previous work is being reviewed, new research pursued, with a focus on getting the facts first.
- The public will be heavily engaged and their input will help drive study activities and outcomes.
- The scientific issues related to climate and physical processes are complex and demand serious, peer-reviewed science.
- Immediate mitigation is premature and not within the current mandate.
- Study results will reflect independent, binational work that is credible and on the level.

**Questions?**

**For more information and to  
submit written comments, visit:**

**[www.iugls.org](http://www.iugls.org)**