The Nelson River Estuary Study:
A focus for the Manitoba Hydro – ArcticNet partnership
Outline

• Manitoba Hydro and Hudson Bay
• The Nelson River Estuary as of focus for MH – ArcticNet partnership
• The Nelson River Estuary Study
• Summary
- The Nelson River is the Significant Part of the Manitoba Hydro Hydraulic System

- Baseline data is required to understand the long term low level impacts to the biota of the estuaries resulting from present and future hydro electric development
Manitoba Hydro and Hudson Bay

• Ongoing collaborative monitoring is needed to better understand the biophysical characteristics of Hudson Bay and ultimately the effects of global warming:
  - determining the accuracy of environmental impact assessment predictions
  - refining regulatory compliance standards
  - defining mitigation measures and their effectiveness
  - through “follow up” programs, developing adaptive processes when predictions are not accurate and mitigation is not effective

• Therefore, Manitoba Hydro has a keen interest in Theme 3 of ArcticNet
Manitoba Hydro Contributions

- Manitoba Hydro Research Management Board Grants to projects 3.1, 3.2, 3.4 and 4.1 ($335,000)
- Direct Theme 3 Funding ($300,000)
- Transportation, Accommodation and Logistical support in Gillam, Churchill and remote sites, including the Nelson River Estuary
- In kind contributions ($5M)
Manitoba Hydro Contributions

- Human Resources

ArcticNet
Board of Directors

Eduard Wojczynski

Engineering/Environmental Departments

Consultant support

Theme 3 Steering Committee

Roy Bukowsky

Bill Girling
The Nelson River Estuary

- Hudson Bay receives >1/3 of Canada’s freshwater drainage – a Theme 3 mandate to better understand freshwater-marine coupling in HB
- The Nelson River drains 1/3 of the total freshwater into HB
Nelson River Drainage Basin = 1,060,000 sq km
Churchill River Drainage Basin = 283,350 sq km
The Nelson River Estuary

- Hudson Bay receives >1/3 of Canada’s freshwater drainage – a Theme 3 mandate to better understand freshwater-marine coupling in HB
- The Nelson River Drain 1/3 of the total freshwater into HB
- The Knowledge on southern HB and more specifically, the Nelson River Estuary and its effects on HB is not enough
Environmental Impact Assessment (1989), Preliminary information on the physical, chemical and biological characteristics of the NRE......
The Nelson River Estuary

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- The Nelson River Drain 1/3 of the total freshwater into HB
- The Knowledge on southern HB and more specifically, the Nelson River Estuary and its effects on HB is not enough
- Potential nutrient and organics source to the largely oligotrophic HB
Water Chemistry Analysis (Baker et al, 1993)

- Most dissolved major nutrients
  - Nitrate
  - Ammonia
  - Total dissolved nitrogen
  - Total dissolved phosphorus
  - Inorganic carbon

- Concentration of major ions
  (Cl, S\textsubscript{o\textsubscript{4}}, Na, K, Mg, Ca)

- Dissolved Organic Carbon
- Soluble Reactive Silica

Increased from Riverine to offshore estuarine zones

Concentrations lower in Surface waters and higher in bottom waters

Nearshore and stratified zones

Increased from Riverine to Offshore zones as water became more saline

Decreased from Riverine to Offshore zones
The Nelson River Estuary

- Many mammals use the estuary in summer to feed, escape predation and rear young
The Knowledge on southern HB and more specifically, the Nelson River Estuary and its effects on HB is not enough.

The Nelson River Drain 1/3 of the total freshwater into HB

The Hayes River – empties into the same estuary

Hudson Bay receives > 1/3 of Canada’s freshwater drainage – a theme 3 mandate to better understand freshwater-marine coupling.

Potentially a source of nutrients and organics to the largely oligotrophic Hudson Bay.

Many mammals use the estuary in summer to feed, escape predation and rear young.
Manitoba Hydro-ArcticNet Nelson River Estuary Partnership

• Unique opportunity when MB Hydro has ongoing studies in the Nelson River Estuary

• Hydrodynamic Modeling
Hydrodynamic Modeling

Nelson River

Nelson River Estuary

Hayes River
Manitoba Hydro-ArcticNet Nelson River Partnership

- Unique opportunity when MB Hydro has ongoing studies in the Nelson River Estuary
- Hydrodynamic Modeling
- Mutual data sharing and logistical costs
- ArcticNet will complement Manitoba Hydro with additional environmental information
ArcticNet perspective on partnership

- Fundamental Scientific Research
- Involving industry, a local stakeholder in the area of our study
- ArcticNet offers a network of experts to draw upon for information
- The Nelson estuary is immense - without Manitoba Hydro’s support, we could not undertake this study to the extent we are
The Nelson River Estuary Study

- **Projects**

  1. Long-term monitoring (bathymetry, annual and seasonal moorings)
  2. Biophysical sampling transects (year round)
  3. Sediment flux monitoring
  4. Ice dynamics
Summer 2005 Programmers

- Bathymetry and LiDAR Survey
Bathymetry and LiDAR Survey

Nelson River Estuary
2005 Bathymetry Requirements

Legend
- Zone 1 - 100m Transsects
- Zone 2 - 50m Transsects
- Zone 3 - 25m Transsects
- Zone 4 - 10m Transsects
- Zone 5 - 5m Transsects
- Optional Bathymetry Areas
- Estuary Mudflats
Moorings

- Seasonal (2005)
  - Bathymetry and LiDAR Survey
  - Seasonal Mooring (Salinity, Temperature, Turbidity)
Mooring (Salinity, Temperature, Turbidity)
Moorings

- **Seasonal (2005)**
  - Bathymetry and LiDAR Survey
  - Seasonal Mooring (Salinity, Temperature, Turbidity)
  - ADCP Transect Measurements
Moorings

- Seasonal (2005)
  - Bathymetry and LiDAR Survey
  - Seasonal Mooring (Salinity, Temperature, Turbidity)
  - ADCP Transect Measurements
  - Water Levels and Flow Measurements
  - Weather Station
Moorings

- Annual Hydro mooring deployed in the Nelson Estuary to compare with ArcticNet mooring north in HB
- To provide annual information on Nelson Estuarine processes
Physical Biological Transects

- To provide more detailed spatial and temporal information of physical-biological processes in the estuary
- Data will contribute to projects 3.1, 3.2, 3.3 and 3.4: CTD profiles, Chl a, TSS, POC, Nutrients, DOC, CDOM, CPOM, O\(^{18}\), Hg/OC’s
- Sites revisited year round
Sediment Flux

- To estimate the volume and pathway of sedimentation (organic and inorganic) in the Nelson Estuary
- In-situ (e.g., ADCP, mooring transmissometers, TSS, etc.) and remotely sensed data (aerial surveys and satellite) will be collected year round
Ice Dynamics

- Ice modifies both physical (e.g., plume extent) and biological (e.g., primary production) processes operating in the estuary.

- To investigate the influence of ice on the estuary and the estuary on the ice cover.

- Data: Historic ice charts, satellite, aerial, and in-situ.
Summary

- Exciting partnership benefiting both Manitoba Hydro and ArcticNet
- The study will provide some of the first information on estuarine processes in the area
- The study has the potential to greatly contribute to our knowledge of freshwater-marine coupling in Hudson Bay
- For more information - contact C.J. Mundy (ummundy0@cc.umanitoba.ca) or K.M. Sydor (kmsydor@hydro.mb.ca)