Upgrading the Avon River Causeway During Highway 101 Twinning

Dr. Bob Pett, NSTIR Environmental Services
Alexander Wilson, CBCL Limited

Transportation and Infrastructure Renewal
Partner with
NS Agriculture

9.5 km

6 lanes
Impacts on the Windsor Salt Marsh (Ramsar Wetland & IBA of Canada)

Unlike the Petitcodiac – keeping an aboiteau

EA completed in 2017 – currently working on design
Project in planning for almost 20 years – including various environmental studies of the Avon River Estuary

Contracted Acadia University, St. Mary’s University and CBWES Inc., between 2002 and 2018 to better understand the estuary and inform our design team to minimize impacts on salt marsh and mudflats.
Baseline CRA Fisheries Study
(Commercial, Recreational and Aboriginal)

Contracted 3 partners for work between April 2017 and March 2019
➢ Darren Porter, commercial fisher,
➢ Acadia University (Dr. Trevor Avery)
➢ Mi’kmaq Conservation Group

Key study goal to better inform the detailed design team to improve fish passage through the aboiteau (sluice)
Just before Christmas 2017, we engaged a team led by CBCL Limited to design an upgraded causeway and aboiteau system.
Design Objectives

Public Safety
- Maintain corridor over Avon River for Highway 101 Twinning and continuity of rail, trail and utility services.
- Continued protection of communities and agricultural land from the effects of flooding and sea level rise / climate change.

Regulatory Requirements
- Improve fish passage (EA Condition & Fisheries Act).
- Minimize environmental impacts (i.e., impact to salt marsh).
- Consideration of potential negative impacts to asserted or established Mi’kmaq aboriginal or treaty rights.

Minimize Socio-Economic Impacts
- On business groups, farming, Ski Martock, paddling clubs, and other recreational users.
Brief History & Ongoing Controversy
Maritime Marshland Rehabilitation Administration (MMRA; 1949)

- Significant federal $
- Projects in 1950s & 60s
- Long-term changes to large watersheds
1858 chart by British Admiralty shows extensive mudflats and salt marshes in upper Avon estuary.

Fundy tides deliver sediments daily - led to soils, habitation & wealth.
Halifax may have been “Warden of the North” but Windsor was the 3rd largest port in Canada between 1836 and 1890.

(after Montreal and Saint John)
van Proosdij et al., 2007

Note flip in channel E→W
River channel had already flipped sides (main channel to the west) and the town wharves were maintained by frequent dredging
Winter 1963

(Photo by C.A. Banks; see van Proosdij et al., 2007)
Why was a causeway built?

Joint decision by local community, provincial and federal gov’ts to better protect agricultural land (marshlands), the community, and its infrastructure from tidal flooding.

➢ Still considered a mistake!
Tidal flood-vulnerable lands (~2,100 ha) above the Causeway and historic dykes (26 km) and Marsh Bodies
Plenty of stakeholders

➢ Farmers
➢ Fishers
➢ Commuters
➢ Truckers
➢ EMO
➢ Recreation
➢ Tourism
➢ ‘Greens’
➢ ‘Cavers’
EA led to CLC creation

www.hwy101windsor.ca

➢ News
➢ Library
➢ FAQ
➢ Meetings

14 members
After nearly 50 years, the aboiteau is at the end of its life. Concrete on the seaward side is failing. Gate bearings, seals and rollers cannot be accessed safely nor replaced. The gate could get stuck at any time – open or closed, the Town and ag-fields would flood.

Engineers recommend replacement within 5 years and note construction will take 3-4 years.

Do Nothing / Status Quo is NOT an option!
Gate stuck open at low tide

Former sand/mud bar
Gate stuck open at high tide
New Design
Falmouth

Retain existing structure

New bridges

3 x 3 lanes

Windsor Salt Marsh
Design Objectives | Manage Water

Public Safety

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Minimize Socio-Economic Impacts

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Water Management Scenarios

Scenario “A”
- Maintain freshwater reservoir, with controlled fishway.

Scenario “B”
- Maintain freshwater reservoir, with controlled fishway and pumping of lake water to maximize fish passage.

Scenario “C”
- Controlled/partial tidal exchange, with open fish passage and dedicated fishways (relatively passive system with limited controls).

Scenario “D”
- Hybrid of Scenarios “A” & “C” to maximize flexibility on control of lake level, improve fish passage, and adaptable as societal goals change and in face of climate change and SLR (active system).

Modelling indicated A & B would not work (insufficient river flow, silt & fish species)
### Spawning Times of Avon River Fish Species

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Scenario “C”

Elevation

Profile

- Fish passage for all species at all times.
- Salt marsh upstream.
- Socio-economic impacts (e.g., view, paddling, future uses).

Modelled aboiteau and fishway design: Partial Tidal Passage
High Tide

Loss of future freshwater resource

Salt Marsh

View
Scenario “D” after initial consultation

What we heard… Save Our Lake!
What's next? Following a process!

Planning, Scientific Investigations, Measurements

Project Initiation, Funding

Engineering Design

Construction

Testing, Operation, Measurements

Operational Procedure Management Committee

Maintenance

End of Life Planning for Future Steps / New Approach

--- 20+ years ago ---  --- ~1 year ago ---  

Now  --- ~4-5 years ---

--- 5 years ---  ---100 years ---

Pre-Design ➔ Options Development ➔ Concept Development ➔ Detailed Design ➔ Tendering and Construction

Start January 2018

WE ARE HERE

- Gather existing information:
  - Drawing
  - Data reports
  - Literature review
  - Topographic surveys
  - Geotech study
  - Constructability review
  - Preliminary dam safety assessment
  - Sea level rise study
  - Preliminary hydrology and hydraulic models
  - Regulatory requirements review
  - Analysis of project requirements
- Public engagement
- Develop design criteria
- Preliminary geometric design (general arrangement):
  - 3 location options
  - Fish passage design
  - Structure foundation options
  - Water management scenarios
  - Develop and test hydrotechnical models for options:
    - Water levels/discharge/velocity (storms and tide)
    - Sediment
    - Salinity (salt concentration)
    - Mechanical and electrical requirements
    - Cost estimates
    - Construction schedule review
- Refine and confirm concept selected:
  - Hydrotechnical model refinement/confirmation detailed.
  - Geotechnical investigation
  - Site design refinement
  - Structures design concept
  - Fish passage design concept
  - Present concept to stakeholders
  - Identify critical design issues
  - Refine cost estimate
  - Mechanical and electrical
  - Building concept
  - Constructability review
  - Develop Phase 2 design scope and schedule
- Finalize design criteria
- Finalize operational requirements
  - Develop construction drawings:
    - Causeway
    - Abutments
    - Fishways
  - Bridges
  - Mechanical, Electrical, Instrumentation
  - Buildings
  - Demolition and Staging
The Process

- Preliminary design options have been developed and we are now seeking feedback.
- Key issues/concerns are being considered for further refinement or development of alternative options in an attempt to develop a solution that balances all interests.

No decision at this time!
Constraints & Realities

➢ Structure at end of life – needs to be replaced in 5 years!

➢ Approvals and construction will take 3-4 years!

➢ Divided community views and little consensus on aboiteau operations!

➢ Potential legal delays!

➢ Politics!
Proposed Aboiteau Ops/Mgmt

Needs & Options
- Consultation
  - Management Plan
    - Independent Monitoring
      - Adaptation

Prior to commissioning the new aboiteau, a Working Group (WG) would summarize the needs and interests, and demonstrate to the public how the diverse interests can be accommodated and meet regulatory, community and opportunity criteria (i.e., an education process).

- Government (municipal, provincial and federal)
- Mi’kmaq
- Local farmers
- Business community
- NS Power
- Ski Martock
- Paddling
- Boating and other recreational users
- Fishers
- Environmental advocates

An integrated lake management plan would then be developed by the WG and implemented by NS Agriculture staff to balance the diverse interests.

In the future, the new structure will require operational reviews for public safety, regulatory compliance (including environmental monitoring), and changing conditions.

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<thead>
<tr>
<th>Regulatory criteria</th>
<th>Community criteria</th>
<th>Opportunity criteria</th>
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<tbody>
<tr>
<td>Mi’kmaq Rights and Treaties</td>
<td>Interests the community defines</td>
<td>Business development opportunities</td>
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<tr>
<td>Flood Protection</td>
<td>Lake levels for recreation (on or near the lake)</td>
<td>Community Planning</td>
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<tr>
<td>EA Requirements: Environmental Protection</td>
<td>Protection of business interests (i.e. Martock, downtown businesses)</td>
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<tr>
<td>DFO Requirements for Fish Passage - must be met as it is law</td>
<td>NS Power</td>
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<tr>
<td>Agricultural Lands Protection - Legal Responsibilities Of NSA</td>
<td>Tourism</td>
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So, NSTIR and NSDA are actively....

Planning for the Annual 100 Year Event

Stay tuned for more information and check-out our CLC website for reports, presentations and project updates.

http://hwy101windsor.ca/