Highway 101 Twinning and Avon River Aboiteau and Causeway

Project Update for Community Liaison Committee

June 19, 2019
Overview

1. General Update
2. Highway 101 Twinning Construction Update
3. Archaeological Program Update
4. Update on the Design of the Avon River Aboiteau and Causeway Upgrading
   • Recap of Aboiteau/Causeway Design
   • Update on Geotechnical Program
   • Update on Phase 2 Design Development
5. Questions / Discussion
General Project Update
General Project Update

**Project Funding:**

• In April the Federal Government announced $32 million in Federal funding under the Disaster Mitigation & Adaptation Fund (DMAF) for the Avon River Aboiteau, Causeway and other improvements to the surrounding dyke system.

• This investment will help strengthen the resilience of the dyke system and reduce risks to public safety by protecting the Town of Windsor, Falmouth and surrounding areas from Bay of Fundy coastal flooding.
General Project Update

**Project Timelines:**

- Overall a 5-year project with completion currently planned by Fall 2022 (currently in year 2 of 5)

- Area between the Windsor Railway and Falmouth Railway crossings (Section 2) will be completed in years 3 to 5 (including the Avon River Aboiteau, Causeway, Interchanges)

- Partial infilling for the widening of the causeway is planned to begin later this summer as it will require time for consolidation (settlement) due to soft sediments in the salt marsh
Highway 101 Twinning Construction Update
Highway 101 Twinning
Three Mile Plains to Falmouth
Highway 101 Twinning Update

Work Completed to Date:

- **Subgrade** for Section 1: Highway 101 westbound lanes, from Trunk 14 (Exit 5) to the Windsor Railway Overpass – 3.4 km
  - Excavation and fill placement (earthworks)
  - Drainage work & initial erosion/sedimentation controls

- **Bridge Structures** at Exit 5 (Trunk 14) and Exit 5A (Wentworth Road) for new westbound lanes
  - Piles, abutments, and girders installations
Highway 101 Twinning Update

Work Scheduled for 2019:

• Completion of Section 1 subgrade including drainage works, final excavation/placement, grading, gravels & site stabilization

• Completion of Exit 5 (Trunk 14) & Exit 5A (Wentworth Road) structures including bridge decks, barrier walls, approach slabs, crash blocks and final site clean-ups and stabilization
Highway 101 Twinning Update

Work Scheduled for 2019:

• **Subgrade** for Section 3: Highway 101 eastbound lanes, from Falmouth Railway Overpass to Existing Twinning – 2.4 km
  - Excavation and fill placement (earthworks), drainage works, grading of subgrade
  - Watercourse realignment
  - Base gravels and final site stabilization

• **Bridge Structures** at Trunk 1 and Falmouth Railway Overpasses
  - Bridge foundations (pile installation, abutments)
  - Girders, bridge deck, barrier walls, approach slabs, approach gravels, final site stabilization & securement
Highway 101 Twinning Update

**Future Contracts (2019):**

- **Section 1 Paving:**
  - Completion of gravels, paving, signage, guardrail, etc.

- **Windsor Railway Overpass Structure**

- **Initial Causeway Widening**
  - Infilling/surcharging for new westbound lanes along causeway and dyke system
Archaeological Program
Retain existing structure

New bridges

3 x 3 lanes

Falmouth

Windsor Salt Marsh

Figure 1
Archeological Resource Impact Assessment (ARIA) and Shovel Testing on the Avon River Banks

Figure 2 – Additional Archaeology Investigation

NSTIR engaged Davis MacIntyre & Associates
Figure 3 – Geotech Drilling Rig

Testing enables detailed design of upgraded road and dyke systems.
Figure 4

Where are the old shorelines prior to dyke construction & salt marsh loss, and hence historic use & occupation?

Recent history – Upland areas at Dimock Point and ‘Elderkin’ Point
Figure 5

Winter 1963

Upland

Upland

(Photo by C.A. Banks; see van Proosdij et al., 2007)
### Figure 6 – Pre-Contact History of Mi’kmaq

<table>
<thead>
<tr>
<th>Mi’kmaw Period</th>
<th>Archaeological Period</th>
<th>Years</th>
</tr>
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<tbody>
<tr>
<td>Sa’qiwe’k L’nu’k</td>
<td>Paleo-Indian</td>
<td>11,500 – 9,000 BP</td>
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<tr>
<td>(the Ancient People)</td>
<td></td>
<td><strong>End of glacial period</strong></td>
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<tr>
<td>Mu Awsami Kejikawe’k L’nu’k</td>
<td>Archaic</td>
<td>9,000 – 3,000 BP</td>
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<tr>
<td>(the Not so Recent People)</td>
<td></td>
<td><strong>Minas Basin forms</strong></td>
</tr>
<tr>
<td>Kejikawe’k L’nu’k</td>
<td>Woodland/Ceramic Period</td>
<td>3,000 – 500 BP</td>
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<tr>
<td>(the Recent People)</td>
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<tr>
<td>Kiskukewe’k L’nu’k</td>
<td>Contact</td>
<td>500 BP – present</td>
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<tr>
<td>(Today’s People)</td>
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</tbody>
</table>

Table 1: Mi’kmaw/Archaeological Cultural Periods
Figure 7 – De-Glaciation ~13,000 years ago

Glacial maximum
24,000 BP

Ice gone by 11,000 BP
followed by wildlife herds
and Paleo-Indians

Figure 2.1-2: Deglaciation of the Minas Basin region showing the ice caps (light blue) and former land areas (green) against the current topography at the temporal margin of the Allerød and Younger Dryas periods.²⁹ (Stea, 2005)
Glacial ice advance/retreat

Figure 2.1-3: Deglaciation of the Minas Basin region showing the ice caps (light blue), formation of glacial lakes (purple) and ocean (dark blue), and former land areas (green) against the current topography during the Younger Dryas cooling event.\textsuperscript{30} (Stea, 2005)
Figure 9 – 9,000 BP

Laurentide Ice Sheet

Minas Basin evolution

Current sea levels by ~6,000 BP

http://www.mikmaweydebert.ca/home/ancestors-live-here/debert/an-ice-age-world

By 9000 years ago, the region is more recognizable. Although PEI is still part of the mainland and small areas of the ocean shelves are still exposed.
Figure 3.4-1: The approximate positions of the 2019 test units (yellow) in relation to the geotechnical boreholes and the surrounding landscape, which is shown in false-colour LiDAR imagery. Late twentieth-century crowning of the marsh fields is clearly seen as the north-south drainage pattern southeast of the units.
Plate 1: Backfilled shovel tests N0 E0 and N0 E5, looking southeast along the ridge line towards the other test unit sites. The Avon River Aboiteau gatehouse and support building can be seen to the upper left as the blue buildings at the edge of the dykeland fields.
40 cm x 40 cm shovel test pits; 1.2 m deep with additional four-corner, hand-augering to a maximum 2.05 m depth in silty-clay sediments; All material sieved through ¼ inch mesh.

No artifacts found (& ‘land’ not habitable)

Sediments below 30 cm were undisturbed glacial till and deposited more than 20 ka BP
Figure 13 – Geotech drilling continues with archaeologists monitoring
Avon River Aboiteau and Causeway Upgrading Design Update
Aboiteau Design Timelines

Phase 1
- Pre-Design & Analysis

Phase 2
- Design Options Development
- Detailed Design
- Construction Documents

Phase 3
- Construction

Jan. 2018
- Apr. 2019
- Mar. 2020
- Oct. 2022

10 -12 months
3 years
Causeway Upgrading
Causeway Upgrading
Causeway Upgrading
Causeway Upgrading
Aboiteau - Hybrid Option D

**Hybrid Option D** was selected as the best solution for the new aboiteau that would proceed to the detailed design phase.

**Key Items to Note:**

- Proceeding to the detailed design phase does not limit potential future operating scenarios.
- The goal is to initially operate in a manner that maintains the lake while maximizing opportunity for fish passage.
- Ongoing monitoring will be required to assess fish passage.
- Option D will still have the ability to operate with partial tidal exchange (Option C) if required to do so in the future.
Aboiteau - Hybrid Option D

Either Gate can be closed as needed

Tide gate

Flap Gate + Active Gate

Flap Gate + Active Gate

Constant water level

Freshwater Fishway

Tidal Fishway
Aboiteau - Hybrid Option D

**Key Benefits:**

- Balanced solution that can accommodate a wide range of interests and concerns
- Additional functionality provides a flexible and adaptable solution to help achieve the goals or requirements of both today and in the future
- Most robust option with greater redundancy for flood protection and public safety, but also for fish passage
- The aboiteau is not limited to a single mode of operation
- Allows for ongoing monitoring and testing to confirm analysis conducted during the design phase
Geotechnical Program Progress

- Started April 24 with areas outside of saltmarsh, including trail area (which is complete with no further access restrictions)
- Analysis of pre-load requirements underway
- Footprint may be larger than anticipated due to soft soils, toe berms will be required
- Planning to drill holes in salt marsh adjacent to existing causeway in the next few weeks
Phase 2 Design Update

- Geotechnical investigation is continuing. Numerous boreholes have been drilled, and samples recovered for testing.
- A 3D computer Model of the aboiteau structure has been created for use in hydrodynamic modelling.
- Hydrodynamic modelling is proceeding to optimize the sizes of the aboiteau barrels and fishways.
- Options for the final location of the aboiteau structure are being explored in conjunction with SMU.
- Modelling to optimize the configurations of the fishways is proceeding.
• A water sampling program is underway to establish baseline water quality information upstream and downstream of the aboiteau structure
• Baseline groundwater sampling/monitoring plan being developed
• Baseline vegetation survey being completed upstream
• Water management scenarios being developed to inform the modelling
• Environmental Permit Applications have been submitted to NSE and DFO where infilling of the salt marsh is expected. Additional Environmental Permit Applications will be completed in the future for the aboiteau structure.
Conclusion / Next Steps

• Option D will continue to be advanced through Design Development (Phase 2)
• Geotechnical Investigation to continue this summer
• Partial infilling for the causeway widening currently planned for later this summer to accommodate further geotechnical investigation, while also allowing for the consolidation (settlement) process to begin on the mud flats
• Regulatory applications for the aboiteau structure will be completed in the future once the design is further along
Questions / Discussion